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*A Name You
Can Depend
Upon*

A GOOD NAME is an asset without which no building product can gain the confidence of men who plan and build. For buildings become lasting monuments to their creators. If the structure endures and gives faithful service, the architect and builder are honored. If shoddy materials or faulty design cause early failure, discredit is reflected. In no other industry is material quality more important, good reputation more essential.

Republic Steel Corporation and subsidiaries offer the most complete line of steel products for the building industry. At your service are more than sixty plants in nineteen states, sales offices strategically located all over the nation, trained research workers and practical engineers, and production and development resources of one of the world's great makers of iron and steel.

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REPUBLIC STEEL CORPORATION

GENERAL OFFICES • CLEVELAND, OHIO

REPUBLIC STEEL'S



ENDURO

STAINLESS STEEL FOR ARCHITECTURE

TIME—CORROSION—RUST—RESISTANT



Central Chevrolet Co., Rochester, N. Y.
Architect — L. H. Friedman, Rochester, N. Y.

Enduro 18-8 used for Pilasters, Door Casings, Coping, Marquee, Marquee Ceiling and Head Trim on Windows.



John C. Wakefield Residence, Winthrop, Mass.

Enduro 18-8 used for Wainscot and Shower Walls, giving a distinctive and beautiful appearance. Enduro also used for downspouts and gutters on this residence.

THERE ARE HUNDREDS OF **ARCHITECTURAL USES** for **ENDURO***

To attempt to list all the hundreds of possible architectural applications of Enduro Stainless Steel would be merely to catalog the uses for any metal in any building. For there is almost no place in which the usual metals are used where Enduro will not prove highly satisfactory. Not only does the beautiful, silvery-white lustre open for the designer an entirely new field of decorative possibilities, but the corrosion-resisting qualities indicate its use wherever there is liable to be danger of atmospheric attack. For example, Enduro has been used for decorative effects in some of the country's finest buildings and yet its qualities make it equally suitable for such practical purposes as heater smoke pipes and conductor pipe, where it has a life many times that of ordinary pipe with the consequent economy and freedom from trouble.

Two Republic Stainless Steels

Of the many different stainless steels, two are of special interest to the architect because they are particularly suitable for architectural applications. These are Enduro 18-8 and Enduro AA. Enduro 18-8 meets every architectural requirement and is generally used for such purposes. Enduro AA is less expensive than Enduro 18-8 and is used to some extent for interior work.

It is realized that some architects may not be familiar

with the many applications of Enduro now being made in the architectural field and the list at right is included simply as indicative of the wide range of possibilities with this unusual metal.

AN INDICATIVE RANGE OF POSSIBLE USES

Air Conditioning Equipment	Doors, Vault	Pilasters
Beer and Liquor Dispensing Equipment	Down Spouts	Pillars
Blowers	Drinking Fountains	Plaques
Bolts and Nuts and Nails	Elevator Dials	Play Ground Equipment
Booths	Entrances	Posts
Boxes, Safe Deposit	Etched Panels	Push Plates, Door
Bulletin Board Frames	Facades	Railing, Decorative
Cabinets	Flashing	Refrigerators
Cable, Wire	Floor Plates and Tread	Risers, Stair
Cages	Flues	Rings, Circular
Casements	Frames, Advertisement	Roofing
Ceilings	Gates	Rosettes
Chairs	Grilles, Radiator and Decorative	Safes
Channels	Hardware	Screens (Frames and Cloth)
Chimney Tops (to prevent down drafts)	Hoods, Range and Laboratory	Scroll Work
Chute Covers	Incinerators	Sheathing
Chutes, Mail	Kick Plates, Door	Shelving
Clock Dials	Laboratory Equipment	Shower Cabinets
Columns	Letters, Stamped, Formed and Cast	Signs
Conveyor Systems	Lightning Fixtures	Sills, Window
Cornices, Copings and Gutters	Lintels, Window	Sinks
Counter Covers	Louvers	Skylights
Courses, Band	Marine Ornamentation	Smoke Pipe for Furnace
Crosses on Churches	Marqueses	Soffits
Desks	Medallions	Spandrels
Display Cases (plain or refrigerated)	Mirrors	Spires
Domes	Moulding, Windows, etc.	Store Fronts
Door Jambs, Sashes and Moulding	Mullions (Exterior and Interior)	Structural Members
Door Push Bars and Plates	Name Plates	Tablets, Memorial
Doors, Elevator	Ornamental Metal Work	Theatre Equipment
Doors, Revolving	Panels, Plain and Fluted	Towers
Doors, Swinging	Partitions	Urns, Decorative
	Piers	Vaults
		Ventilators and Ducts
		Vestibules
		Window Frames
		Wire Cables

*Reg. U. S. Pat. Off.

REPUBLIC STEEL CORPORATION





Westchester County Home, East View, N. Y.
Architects — Morris & O'Connor
An interesting application of Enduro 18-8 on Sinks, Tables and Counters, showing flexibility of usage.

Important Information to Assist the

Architect

In Designing and Specifying
Enduro Stainless Steel to meet best
the Requirements of his Project

ENDURO

Republic's Perfected STAINLESS STEEL

ENDURO is the trade name identifying the group of Stainless and Heat-resisting Steels perfected by Republic Steel Corporation at its Alloy Steel Division, Massillon, Ohio. In these pages it is our purpose to present the unusual characteristics and wide range of possible applications of this newest of metals.

Radio Station WCAU, Philadelphia, Pa.
Architect — Gabriel Roth
Enduro 18-8 used for face trim, letters and doors.

STAINLESS STEEL ARCHITECTURAL SERVICE

In the discussions on the pages which follow, emphasis has been laid on the necessity for selecting the proper type of steel to meet the particular conditions of the use contemplated. To assist the architect in specifying that type which will most satisfactorily meet his requirements, we offer the services of the Metallurgical Department of Alloy Steel Division, REPUBLIC STEEL CORPORATION, with its completely equipped modern laboratories where authorities are continually studying every factor connected with the production and application of stainless steels and where specialized advice is freely available.

In connection with the uses of stainless steels shown and described herein it should be borne in mind that REPUBLIC STEEL CORPORATION does not sell or furnish the products direct. The Corporation produces only the unfinished material which is fabricated by others. Any of the district sales offices listed on the back cover will be glad to cooperate with the architect and suggest fabricators who are experienced and qualified to handle the work. They will also advise the architect on questions of specifying, detailing and installation.

For such advice or assistance, please call the District Sales Office or the distributor nearest you or write to the Alloy Steel Division of the Corporation at Massillon, Ohio. Samples of various finishes will be furnished any architect on request.

ALLOY STEEL DIVISION, MASSILLON, OHIO
GENERAL OFFICES • CLEVELAND, OHIO





General Description, History, Range, Capa- bilities and Types of Stainless Steel

Comparison of Stainless Steel and Stainless Iron

Characteristics Analysis and Physical Properties of Enduro 18-8

Enduro Stainless Steels are silvery-white in appearance and cannot chip, crack or wear thin as they are the same metal all the way through. With reasonable care they do not tarnish, corrode or become dull when properly applied. They can be worked and fabricated for any purpose. They can be given a number of different finishes or combinations, or may be etched and enameled to produce unusually beautiful effects. They may be combined with colored porcelain enamel (or with other metals) to produce a wide variety of pleasing effects. In brief, the unusual properties of Enduro Stainless Steels indicate their use not only for the finest of decorative effects but also for every application subject to possible corrosion.

Probably few persons not directly connected with the industry appreciate the wide range of uses now being made of stainless steel. A list of these would be a roll call of almost every manufacturing process in the United States. From cooking utensils to automobile parts, from golf clubs to bank vaults, stainless steel is finding new applications every day. In the engineering, chemical, power and oil refining fields, the corrosion- and abrasion-resistance and strength of stainless steel at high temperatures are essential.

Although chromium, the element, was discovered in 1789 and the acid-resisting properties of chromium-iron alloy appreciated as early as 1821, it was not until within the past twenty years that commercial application has been made of such alloys. Since 1913 hundreds of patents have been granted both in this country and abroad for various stainless alloys.

Naturally this flood of patents has led to considerable confusion, particularly among laymen, as it seems that nearly every steel manufacturer has entered the stainless field to make this or that analysis. Rash claims have been made regarding the performance of these alloys and far too often the application has been made to suit the alloy on hand rather than applying a specific alloy which would give the desired results.

While different trade designations are still used by various manufacturers, standard type numbers have been assigned to all stainless steel analyses. This has been done under the supervision of the American Iron and Steel Institute.

Technically there is a distinction between stainless iron and stainless steel, although the latter term is popularly, if erroneously, used to designate all stainless alloys.

Stainless Iron generally is an alloy of iron and chromium, or of iron, chromium and nickel, with a *very low carbon* content. The stainless properties of the alloy are due to the ability of chromium to form with iron a solid solution which is resistant to the various corrosive media. It is essential that sufficient chromium be present in solid solution to ensure stainless properties. The chromium content of Enduro Stainless Irons has been adjusted accordingly.

Stainless irons, or stainless steels as they are popularly known, as a class do not respond to hardening by heat treatment. Neither do they require special heat treatment other than that received at the mill to develop stainless properties. Stainless steel lends itself to deep drawing and other forming operations.

To meet the demand for corrosion-resisting alloys suitable for a wide variety of specific purposes, Enduro Stainless Steel has been developed in a number of types. In this development, all factors affecting corrosion-resistance have been considered and their relative importance established. The result is a series of alloys possessing maximum corrosion-resistance and physical properties, consistent with ease of workability, for each field of application. Two of these steels were especially developed for architectural uses and are described in detail on the pages which follow.

ENDURO 18-8 Enduro 18-8 contains approximately 18 per cent of chromium and 8 per cent of nickel with carbon over .03-20 per cent. The addition of nickel—a metal possessing in itself considerable corrosion-resistance—to the stainless analysis greatly increases the corrosion-resistance of the alloy, extending this resistance to a number of materials which attack stainless chromium iron, to the point of complete immunity from attack. The addition of nickel also increases resistance to scaling at high temperatures, reduces grain growth, and at the same time lessens embrittlement after long service at high temperatures. Metallurgically, the effect of the nickel is to produce an alloy of the stable austenitic type; characterized by extraordinary toughness and ductility, no capacity for hardening under heat treatment, high resistance to impact, and the property of being non-magnetic. To take full advantage of the addition of nickel, certain processing is necessary and this forms an important part of the Enduro production method.

TYPICAL ANALYSIS AND AVERAGE PHYSICAL PROPERTIES OF ENDURO 18-8

Analysis

Carbon.....	over .08-.20%
Chromium	17.5-19.0%
Nickel	8.0-9.5%
Silicon75% max.
Manganese60% max.
Sulphur030% max.
Phosphorus030% max.

Weight—virtually the same as steel—.286 lb. per cubic inch.

Thermal Conductivity expressed in calories per centimeter cubed: .035 Resistance to High Temperature Scaling.

Continuous Service 1600° F.

Intermittent Service 1450° F.

Co-efficient of

Linear Expansion—Temperature x 10⁻⁶

0- 100° C. = 16.0

0- 300° C. = 17.0

0- 600° C. = 18.0

0-1000° C. = 20.0

Melting Point (approximately 2550-2600° F.)

Cold working increases the ultimate strength and yield points over those shown above but reduces ductility.

Average Physical Properties Annealed (24 Gauge Sheet)

Ultimate Strength	85,000 lbs. per sq. in.
Yield Point	35,000 lbs. per sq. in.
Elongation in 2 in.....	55.0%
Elongation in 4 in.....	50.0%
Elongation in 8 in.....	45.0%
Rockwell B.....	80.0
Olsen Cup Test.....	.450-.500

(Lighter gauges will have lower cup values)

Average Physical Properties (Annealed Round Bar Stock Up to 2 in. Rd.)

Ultimate Strength	85,000 lbs. per sq. in.
Yield Point	35,000 lbs. per sq. in.
Elongation in 2 in.....	55.0%
Red. Area	65.0%
Rockwell B	80
Brinell	156

(Larger sizes will have lower strength values)

It is not uncommon to find 250,000 lbs. tensile strength, 2% elongation and 40-45 Rockwell "C" hardness in cold drawn 18-8 wire.

Cold rolled strip having 150,000 lbs. ultimate strength, with 20% elongation in 2 in., can be obtained. It will stand a 135° bend across the grain of the metal and 135° to 180° with the grain.



Characteristics, Analysis and Physical Properties of Enduro 18-8 (Continued)

FABRICATING ENDURO 18-8

The proper fabrication of any metal is a most important part of a successful installation and for this reason the data below are presented for the information of the architect who may be unfamiliar with the best methods of working and forming Enduro 18-8. Enduro 18-8 is one of the finer metals and should be handled similarly to other high grade materials rather than attempt to fabricate by employing methods generally used on common iron or steel products.

Enduro 18-8 is well suited for deep drawing, punching and shearing. Its extremely high elongation and low yield point are indicative of what may be expected of this alloy as compared to regular deep drawing steel. It should, however, be pointed out that Enduro 18-8 work-hardens very rapidly and to a much higher degree than does regular drawing steel. For this reason it is necessary to perform as much work as possible in a single drawing operation and to reanneal between operations. The blanks used should be of sufficient size not to require excessive ironing out in the dies to secure cup depth, as the work-hardening characteristics of the alloy may cause high breakage loss as well as excessive wear on the dies. The use of a special lubricant of suitable consistency and body is quite important. A number of suitable drawing compounds are obtainable from chemical supply concerns and lubricant manufacturers. Speed of the press should be about one-half that used for steel and press capacity should be doubled. Hold-down pressure must be greater than that required for ordinary steel and will vary with the job. Die clearance should be about twice that used for steel or brass.

The work hardening characteristics and high tensile strength of Enduro 18-8 make it necessary to use more power in performing drawing operations than is required in forming and drawing steel of a similar gauge. A very close adjustment of shear blades and of clearance between punches and dies is recommended for punching and shearing operations. The power required will be greater for the reason previously given and it will be necessary to shear through the entire thickness of metal rather than permit it to snap off after a portion of the cross-section has been cut through, as occurs in punching most materials.

Enduro 18-8 is ideal material for rivets. As it does not harden on rapid cooling, nor develop coarse crystalline structure on heating, the more accurate temperature control required for straight chromium iron rivets is not necessary. Rivets when driven hot should be heated within a temperature range of 2100-2200° F. Smaller size rivets may be driven cold, as they remain tough and thoroughly dependable. Hot driving is recommended for rivets over 3/16 in. in diameter.

Enduro 18-8 may be welded by either the acetylene torch or electric arc, using specially prepared Enduro 18-8 welding rods or electrodes. It may also be spot and resistance welded, but cannot be forge or hammer welded. Seam welding of light gauge sheets is readily accomplished. Having no capacity for hardening, welds remain tough and ductile and do not develop the coarse, "weak" crystalline structure characteristic of the straight chromium iron alloys.

For acetylene welding, uncoated welding rods should be used. With plates and other heavy materials, chamfer the edges to be welded and place these a small distance apart. Build up a bead between these edges, keeping the flame pointed in the direction

The Importance of Proper Fabrication in Successful Installations

Deep Drawing, Punching and Shearing Qualities of 18-8

Riveting — Enduro 18-8 is ideal material for Rivets

Welding Qualities — Methods by which Enduro 18-8 may be welded



Ways in which Enduro 18-8 may be welded (continued)

Soldering of Enduro 18-8 produces strong and firm joints

Brazing and Silver Soldering — Satisfactory Fluxes

Machining and Drilling are best accomplished with Enduro 18-8-FM.

Protecting the Surface of POLISHED Enduro during Forming, Drawing, Moulding, Construction and Erection

Preventing of Injury During Fabrication

Protection during Building Construction

Passivation and Passivation Tanks

of welding so as to preheat the work. Use a slightly reducing flame, and see that it is no larger than necessary for the work to be done. For electric arc welding, specially coated rods or electrodes must be used. Reverse polarity (electrode must be positive and work the negative pole) and regulate the machine to give the same or lower voltage than would be used with plain steel rods, and with sufficient current to give good fusion. Definite instructions cannot be given as much will depend upon the character of the work and the type of machine used. (See Enduro Welding Booklet for further information.)

While welds made with Enduro 18-8 are naturally tough and ductile, the annealing treatment previously mentioned is strongly recommended if the welded material is to withstand severe corrosive attack. This treatment will tend to remove the difference in structure between the weld and the adjacent metal, which is the primary cause of local attack in welded structures. Where acid corrosion may be encountered and annealing of the weld is not possible, Enduro 18-8-S should be used.

Enduro 18-8 may be soldered without difficulty, producing firm, strong joints. For pickled finish sheets, the ordinary muriatic acid, cut with zinc, may be used. However, better results will be obtained with special commercial fluxes, used with ordinary solder, and by pursuing the same procedure as with copper, tin, terne, etc. For polished sheets, the surfaces to be joined should be roughened with a coarse emery wheel or cloth before tinning.

The metal comprising the joints should be properly tinned before assembly. The half tin, half lead type of solder may be used but solder with higher tin content such as 75% tin—25% lead is recommended because it does not discolor as rapidly under atmospheric exposure. Pure block tin can also be used. On account of the low thermal conductivity, use a large soldering iron which will have sufficient heat capacity to heat the metal thoroughly. Immediately after soldering, *all traces of acid must be thoroughly removed* by washing with soap and water to which has been added some washing soda, as the acid attacks the metal readily and will stain if not removed. Soldering should not be depended upon for strength but simply to seal the joint. Riveting, lock seaming or spot welding should be used for strength. Rivets should be tinned to insure adhesion of the solder before driving which, of course, is done cold.

We recommend welding rather than brazing whenever possible due to the excellent welding properties of 18-8 and to the possibility of intercrystalline penetration of the brazing alloy. This lowers corrosion-resistance and causes embrittlement of the joint under wet corrosive conditions by favoring electrolytic action. Brazing must be carefully done to prevent the penetration of brazing alloy into the grain boundaries of the metal.

For brazing and silver soldering proceed in the usual manner, observing the precaution of having the metal just sufficiently hot for good adhesion. Special stainless steel brazing flux should be used.

Being an austenitic alloy, Enduro 18-8 is tough and somewhat difficult to machine. In order to overcome the machining difficulties heretofore confronted, Republic has produced a free machining 18-8 alloy which is termed ENDURO 18-8-FM. This free machining alloy, as its name suggests, simplifies to a great extent turning, milling, boring and drilling operations. Its corrosion-resisting properties are comparable to those of the regular ENDURO 18-8. Best results are obtained with slow cutting speeds and moderately heavy cuts.

Many applications of Enduro permit the use of mill polished sheets such as No. 4 finish, No. 6 Tampico finish, No. 7 finish and No. 8 mirror finish. A few of these applications are—soda fountain and bar equipment, dairy equipment, meat packing equipment, hospital and kitchen equipment, restaurant and cafeteria equipment and for structural and decorative purposes such as used on the Empire State, Chrysler, Insurance Co. of North America Building and many others.

The polished surfaces must be carefully protected during fabrication. This is accomplished by proper lubrication or by the use of protective paper and tape in brakes.

When Enduro is used for decorative purposes in building construction it must be protected from cement, plaster, paint, rust from steel work and other "building filth." This may be done by coating with special lacquer which is removed when construction is finished, or by pasting Manilla paper over the surface.

The passivation treatment consists of immersing the material, after removing any grease film, in a 25% by volume solution of nitric acid and water at a temperature of 120-130° F. for 20-30 minutes. The purpose of the passivation treatment is to remove any trace of iron or steel which has become abraded on the stainless steel due either to shearing or contact with dies in forming operations. The nitric acid bath will remove this film of iron without affecting the surface of the polished stainless steel.

Bulletins covering in detail each of the operations and treatments which may be applied to Enduro Stainless Steels are available and will be sent gladly to any architect on request.

ENDURO AA Enduro AA is a straight chromium alloy. It is a fairly ductile, non-hardening alloy with physical properties equal to a high grade medium carbon steel, with resistance to general corrosion and oxidation at high temperatures.

It is recommended *only for interior applications* as its resistance to corrosion is not equal to 18-8.

Fabrication in general is similar to 18-8 except it does not possess the same degree of ductility or welding properties, and does not work harden to any great extent.

All welded joints in straight chromium alloys (without the addition of nickel) have a tendency to embrittlement at and adjacent to the weld, due to the high temperatures required for welding, which causes excessive grain growth.

TYPICAL ANALYSIS AND AVERAGE PHYSICAL PROPERTIES OF ENDURO AA

Analysis	
Carbon12% max.
Chromium	14.0—18.0%
Silicon50% max.
Manganese50% max.
Sulphur03% max.
Phosphorus03% max.
Weight per cubic inch—virtually the same as steel. (.277 lbs. per cu. in.)	
Thermal Conductivity expressed in calories per centimeter cubed: .045	
Resistance to High Temperature Scaling—	
Continuous Service 1500° F	
Intermittent Service 1600° F.	
Coefficient of	
Linear Expansion—Temperature $\times 10^{-6}$	
0-100° C. =	9.6
0-300° C. =	10.1

0-600° C. =	10.9
0-800° C. =	11.2
Melting Point—	2650°-2700° F.

Average Physical Properties (Annealed Sheet)

Ultimate Strength	80,000 lbs. per sq. in.
Yield Point	50,000 lbs. per sq. in.
Elongation in 2 in.	26.0%
Elongation in 4 in.	22.0%
Elongation in 8 in.	18.0%
Rockwell B	80

Average Physical Properties (Annealed Round Bar Stock)

Ultimate Strength	80,000 lbs. per sq. in.
Yield Point	50,000 lbs. per sq. in.
Elongation in 2 in.	25.0%
Reduction of Area	60.0%
Brinell	160

SHAPES • SIZES • FINISHES OF ENDURO STAINLESS STEEL

Enduro Stainless Steel is furnished in the forms listed below. In addition to these Enduro may be cast and the architect will find many uses for which cast stainless steels are especially appropriate. All shapes are made by fabrication and either formed, rolled or drawn. In the present state of the art Enduro does not lend itself readily to the extruding operation. For detailed information consult any Enduro Stainless Steel Distributor or any of the Republic District Sales Offices listed on the back cover.

Rounds—Hot rolled, cold drawn, centerless ground and polished.

Squares—Hot rolled and cold drawn.

Hexagons—Hot rolled and cold drawn.

Flats—Hot rolled and cold drawn.

Sheets—Standard gauges and sizes, annealed and pickled, polished one side and polished both sides.

Plates in practically any size and thickness obtainable in plain steel; large size one-piece flanged and dished heads.

Strip—Hot rolled and cold rolled.

Forging Blanks—Any reasonable weight or size.

Shapes, Angles, Channels, I-beams, etc.—Sizes on application.

Tubing, seamless, Republic electric resistance welded. Pickled or polished.

Welding Rods, $\frac{1}{8}$ in., $\frac{5}{32}$ in., $\frac{3}{16}$ in. diameter. Coated and uncoated carried in stock for electric and acetylene welding.

Castings can be furnished of Enduro 18-8 analysis by special arrangement.

Bolts and nuts, rivets, screws, nails, tacks, spikes, wire and many other items of Enduro Stainless Steel can be obtained from various sources. Names of manufacturers will be gladly furnished.



Characteristics and Recommended Uses of Enduro AA

Shapes, Sizes and Finishes



Suggestions on the Selections of Finishes — Designations for Sheet Finishes

Enduro Stainless Steel Strip

Installation Examples

Of primary importance to the architect in designing with Enduro Stainless Steel are the many different finishes in which this unusual metal may be obtained. Unlike plated materials, Enduro is the same beautiful color throughout and has no coating to wear off. As it is proof against tarnishing and corrosive attacks when properly fabricated and installed, it can be used with every assurance that the original effect will be retained during the entire life of the building.

FINISH DESIGNATIONS

The various sheet finishes are designated as follows:

- No. 1 Hot rolled annealed and pickled
- No. 2-B Full Finish (Bright cold rolled)
- No. 2-D Full Finish (Dull cold rolled)
- No. 4 Standard Polish on one side or both sides
- No. 6 Standard Polish, Tampico Brushed on one or both sides
- No. 7 High Lustre Polish on one or both sides
- No. 8 Mirror Finish on one or both sides

Although the architect will probably select the finish to produce the special effect desired, certain restrictions should be borne in mind and the advice of Republic Steel Corporation representatives or distributors secured on any problems not covered here. For example, the finish possible on the stock will depend to a considerable extent on the amount of forming necessary. It is inadvisable to use polished sheets for extra deep drawing operations where score marks from dies are likely to occur in forming or where it is necessary to reanneal to make a second drawing operation. Our No. 1 Finish should be used under these conditions.

Numerous other applications of the No. 1 Finish may be made at points where appearance is not a primary factor but where corrosion-resistance is important, such as mail chutes, tanks, tubing and a variety of other uses.

No. 2B Finish and No. 2D Finish are the same as No. 1 except that they have a slightly higher finish due to cold roll processing.

Polished finish should be used only where stock will be employed without further working, where the degree of working is small or where finish can be protected so that excessive refinishing is unnecessary.

No. 4 Finish, being ground and polished, is very satisfactory for interior application. It possesses a ground surface appearance with a medium lustre and is considered the best commercial type of finish for such applications as bank vaults, restaurant and soda fountain equipment, sterilizers, laundry machinery, packing house refrigerators and equipment, cold storage, canning and preserving equipment, trim for cabinets and numerous other places where a fairly high lustre and ease of cleaning are desired.

No. 6 Finish has a silvery lustre and does not have as high a reflectivity as No. 4. It can often be used to blend in conjunction with finishes of higher lustre or other metals. Higher lustre finishes, such as No. 7, are obtainable and are similar to No. 4 with the exception that the lustre obtained by buffing is much brighter.

No. 8 Finish is the highest obtainable in commercial steel practice. All of the grinding lines are removed and a sheet of high reflectivity is obtained. This finish is used for mirrors and for trim where highest lustre is required.

The finishes of Enduro Stainless Steel strip are designated as follows:

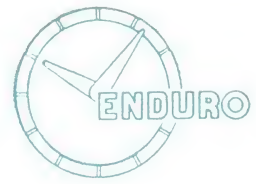
- No. 1 Cold rolled, annealed and pickled. Surface has dull sheen.
- No. 2 Cold rolled, annealed, pickled and given light skin pass. Somewhat brighter surface than No. 1.

A REVIEW OF SPECIFIC INSTALLATIONS

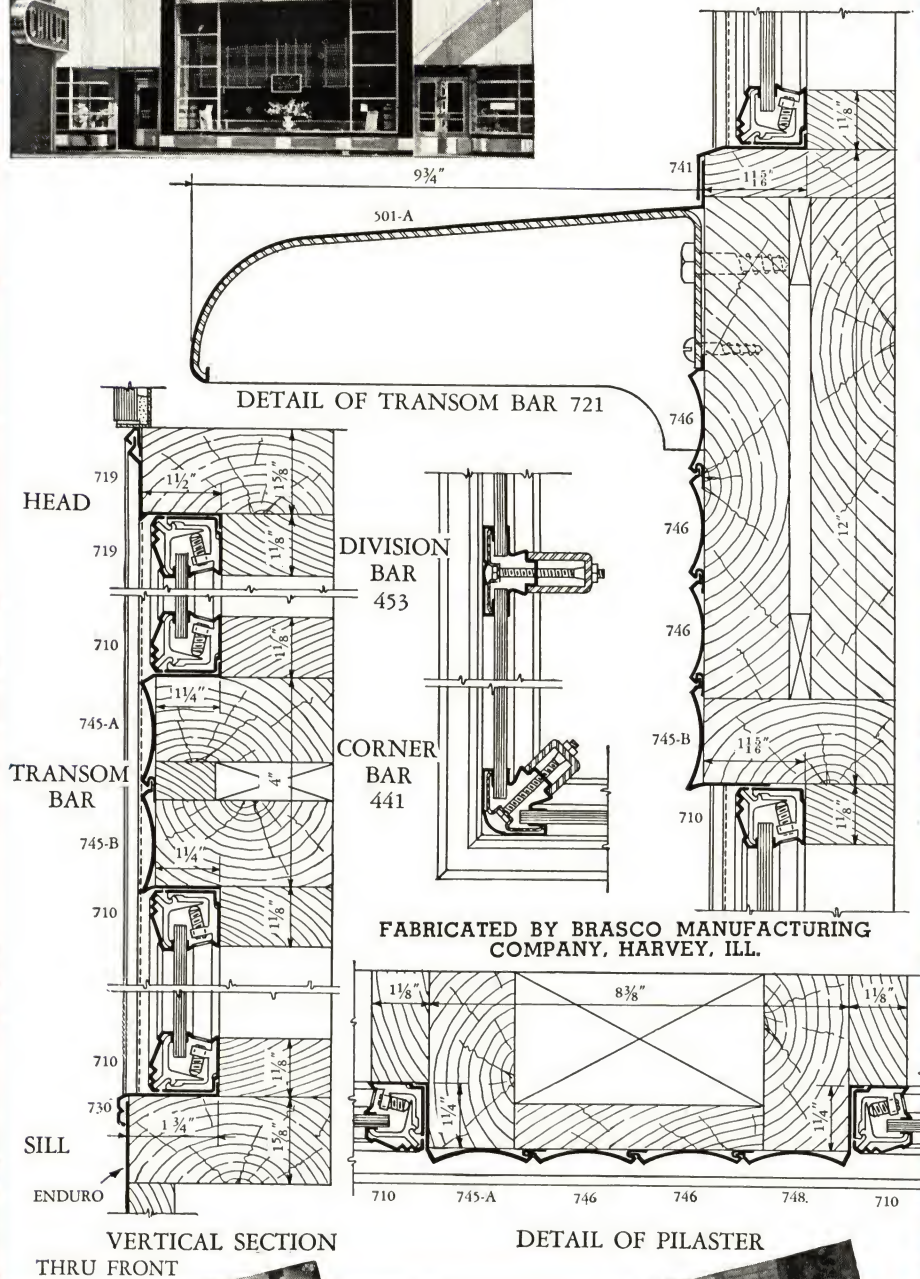
It may be interesting to review the processing procedure applied to the Enduro sheets used on the Chrysler and Empire State Buildings and more recently on the Richman Bros. Building, Detroit, and the Insurance Company of North America Building, New York, as these may be considered typical of such architectural applications. The sheets, which were of Enduro 18-8, after being hot rolled, annealed and pickled, were rough ground with No. 80 grit used dry, followed by successive grease wheels of 100-120, etc., until the finish desired was obtained. The Chrysler sheets received a relatively high finish followed by buffing and passivation (in nitric acid).

The Empire State Building, Richman Bros. Building, and the Insurance Company of North America Building sheets had a medium finish, followed by a special wheel to dull the lustre, giving a No. 6 Tampico finish. These sheets likewise were given the passivation treatment; then after being formed into panels at the fabricators' plants, they were again passivated, following the removal of the drawing compound by the use of gasoline and whiting. In the foregoing descriptions it has been impossible to give more than a general idea of the appearance of each and the differences between the various effects possible. It has also been found impossible to show these finishes by half-tone engravings. For these reasons we suggest that the architect secure samples of the various finishes from Republic District Sales Offices or Enduro Distributors before making a definite selection.

ENDURO STORE FRONT CONSTRUCTION



APPLICATION OF ENDURO
STORE FRONT CONSTRUCTION



In the present trend toward modernism in store front design, usually involving the use of gleaming white metals, Enduro fits perfectly.

The attractive appearance, complete resistance to corrosion and tarnishing, and a wide variety of finishes of this metal, make it the ideal material for the finest of decorative effects as well as for every purpose subject to possible corrosion. Because of these qualities, it is natural that Enduro has come to occupy a most important place in modern store front construction.

In designing a store front the architect plans for a very definite effect. To accomplish this he must use materials which will be striking in appearance, which will contribute to the attention-getting character of the complete design and yet which will not detract from the principal purpose of any window, namely, the sales-influencing display of goods. Likewise, of utmost importance to the designer as well as to the store owner, is the matter of upkeep or cleaning.

It is therefore essential that the architect select a metal which will retain its original beauty as long as it is in place and one which will require only a minimum of cleaning. Enduro will withstand the corrosive action of most acids, smoke and rain water. Washing down the window glass, with its accumulated dust, cannot stain the gleaming surface of Enduro Stainless Steel.

In selecting Enduro the architect will find it a decided advantage to be able to use the same metal for glass settings, awning bars, lettering, display signs, ornamental trim, in fact, for every part of his design.

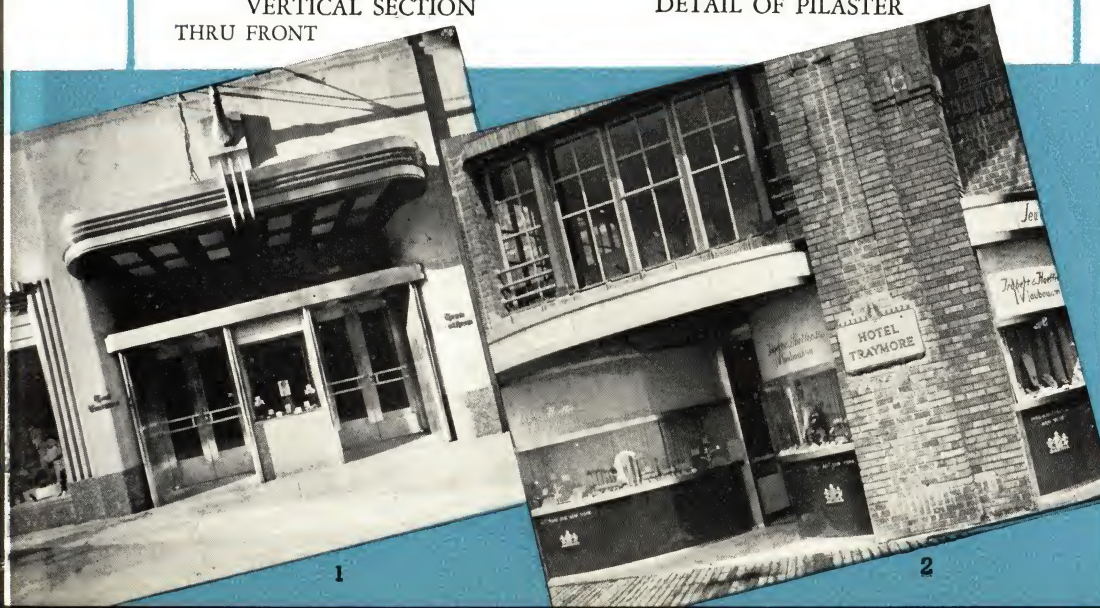


1. Hess Bros. Department Store
Allentown, Penna.
Architects—Thalheimer & Weitz
Philadelphia

Enduro 18-8 used for window trim, doors, ornamental trim over entrance doors and lobby.

2. Trabert & Hoeffler, Inc.
Atlantic City, N. J.
Architect—J. M. Berlinger

Enduro 18-8 used for ornamental trim.



OTHER APPLICATIONS OF ENDURO IN STORE FRONT CONSTRUCTION

Modern design trends have made the store front increasingly prominent in influencing consumer action. Today, the modern store, to attract, must have its own individuality. Its construction materials, therefore, are required to perform a dual function.

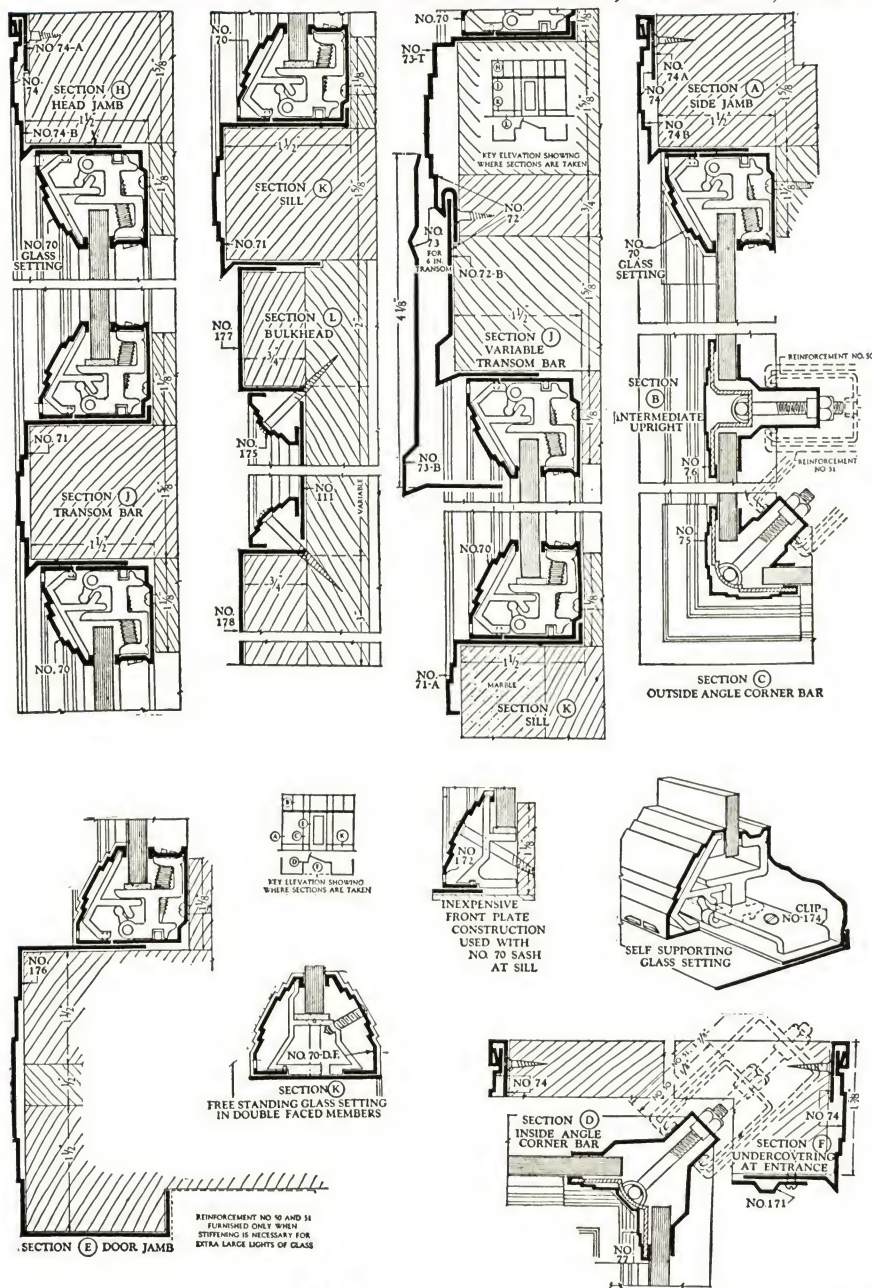
Architects, in recent years, have discovered in Enduro this combination of ease of maintenance, remarkable durability—and unusual versatility. Enduro is no longer restricted to simple ornamental trim—but now includes such applications as embossed signs, medallions and trademarks of a highly decorative nature. In addition, Enduro is also performing a useful service in the form of ventilating louvers and grilles which possess unusual eye-appeal as well as serving their useful purpose.

The architect will indeed be forced to exert his imagination to conceive a usage employing metal—either decorative or practical—that cannot be interpreted in Enduro. The enduring beauty of this metal—coupled with its year-after year durability—rank it as the logical choice for store fronts of outstanding sales influence.

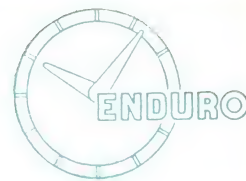
The three store front construction drawings shown on these pages illustrate practical methods of employing Enduro to meet these conditions effectively. The drawings shown do not attempt to present minute details—but merely serve to give an idea of the typical methods employed for fabricating and installing Enduro.

For dynamic attention value, combined with unusual durability and low upkeep cost—specify ENDURO for store front construction.

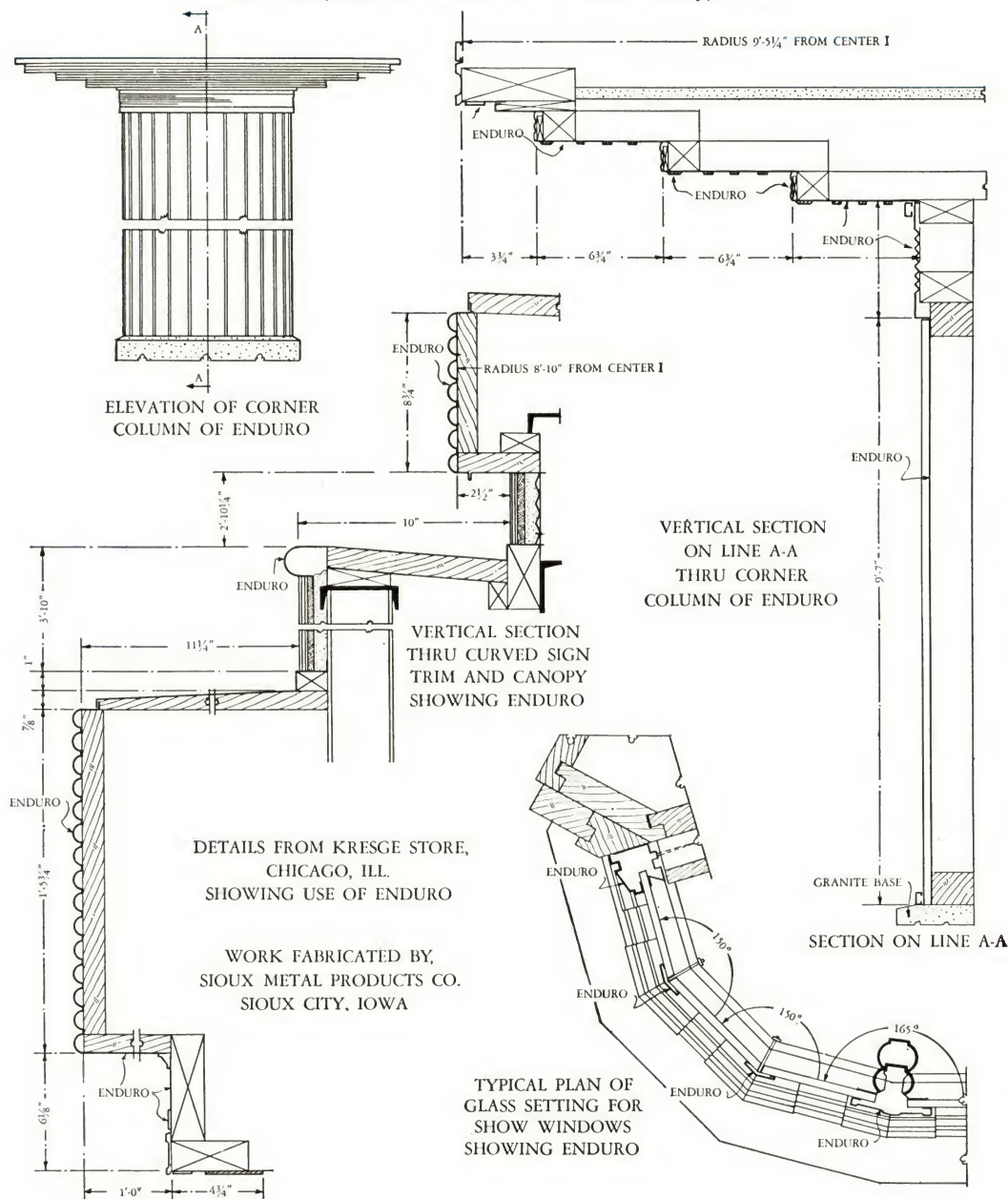
"HIMCO" No. 70—The Himmel Bros. Co., New Haven, Conn.



FRONT CONSTRUCTION



INSTALLATION DETAILS OF ENDURO Fabricated by Sioux Metal Products Co., Sioux City, Iowa



1. Rosinski Furniture Store Lackawanna, N. Y.

Architects—Rosinski & Jakiel

Enduro used for side jambs, sills and top bands. The sign letters are made entirely of 20-gauge Enduro, an interesting application.

2. Federal Dept. Store Detroit, Michigan

Architect—Charles N. Agree
Detroit

The base trim and piers of this modern department store are Enduro.

3. Zingesser's Bakery Bronx, New York

Designed by Pollack and Son

The use of Enduro for this store front and sign have definitely increased the business of this bake shop.

4. Booth Theatre Detroit, Michigan

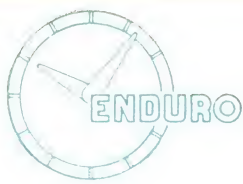
Architects — Bennett & Straight

Enduro trim employed to set off the porcelain enamel on this attractive theatre.

5. Burt's Shoe Store Chicago, Illinois

Enduro 18-8 greatly enhances the attractiveness of this shoe store. Its gleaming beauty will endure for years.





SPANDRELS, TRIM AND ARCHITRAVES OF ENDURO

SPANDRELS, TRIM

Building construction today is taking full advantage of the many practical benefits offered by metal spandrels and trim. For not only do these spandrels and trim offer a wide range of decorative possibilities, but, because of their combined strength and light weight, they ardently follow the present-day trend toward simpler building design and construction. In addition, metal spandrels reduce the dead load on the framework and make possible a reduction in wall thickness between structural columns.

Enduro Stainless Steel, because of its many inherent characteristics, is widely used in spandrels and trim work on buildings of all varieties. This "newest of metals" lends itself to easy fabrication, intricate designing and ready installation. In addition, it is highly resistant to corrosion and will not streak adjoining surfaces. This feature is highly important to architects and building owners.

ARCHITRAVES

The characteristics that make Enduro Stainless Steel so remarkably suited to spandrels and trim, likewise enable this new metal to take its place as the finest metal for architraves. Strong, light in weight, easily fabricated and decorated, architraves of Enduro are built to withstand the ravages of the elements and years of hard wear.



1. Canadian National Railway Station, London, Ontario Architect—John Schofield, Esq.

Enduro used for inner and outer door and vestibule in this modern railway station.

2. Metal Landing Rail for Apartment House Columbus, Ohio

Fabricated Enduro Stainless Steel and Bronze, by Loeben Ornamental Metal Works, Philadelphia, Pa.

3. Sheffield Farms Store Cleveland, Ohio Fabricator—Liquid Carbonic Co. Chicago, Ill.

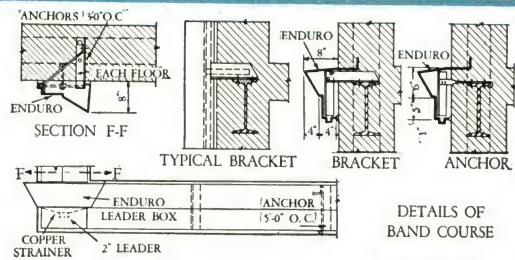
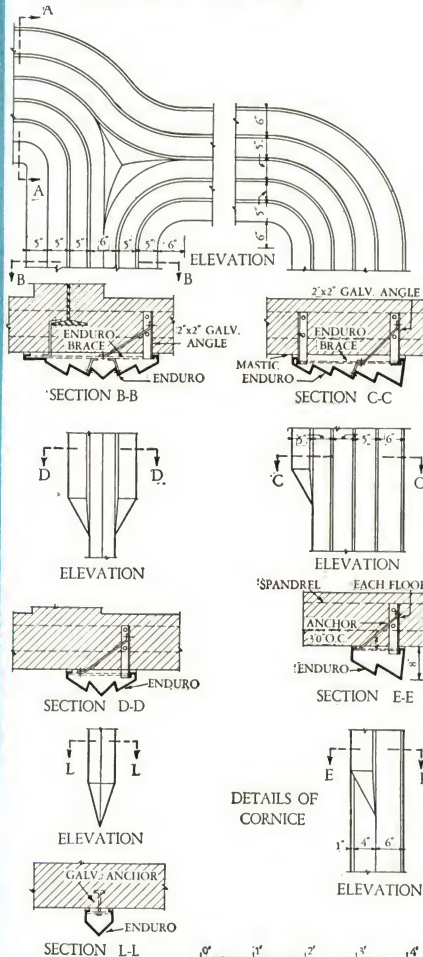
Enduro used for back of counter working surfaces in this attractive soda fountain.

4-5. The Merry-Go-Round Newark, N. J.

Designed by Charles Shilowitz
Enduro used in fabricating the beautiful back-bar which is built to provide working space for eight bartenders. All sinks, work benches and the doors to the compartments below the sinks and drainboards are Enduro.

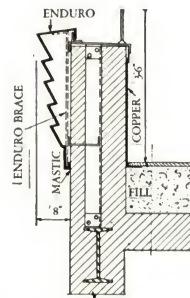


Apartment House at
West End Avenue and 80th
Street, New York City

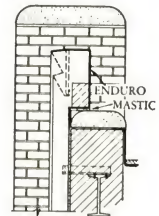


Details of
Band Course

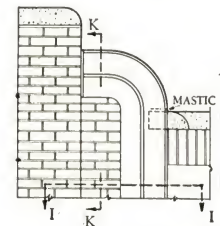
DETAILS OF
BAND COURSE



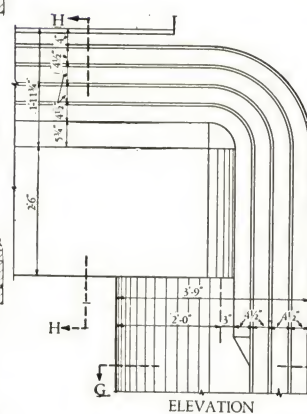
SECTION A-A



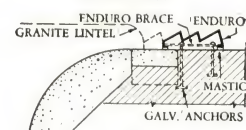
SECTION K-K



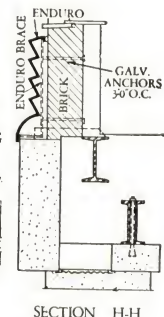
SECTION I-I
Details of
Tank Tower
Trim



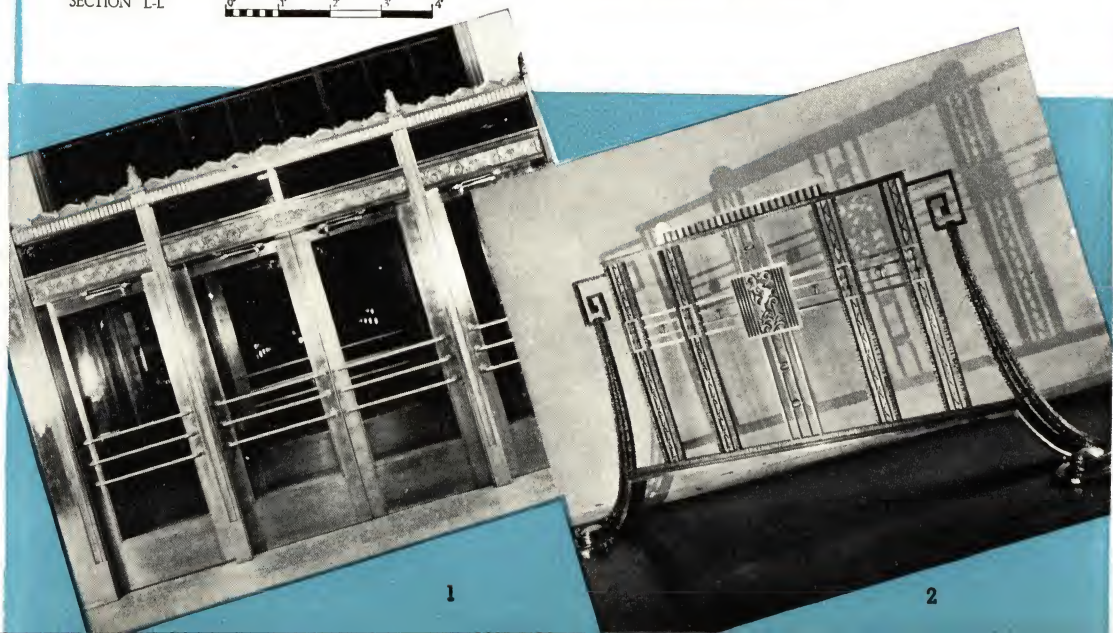
ELEVATION



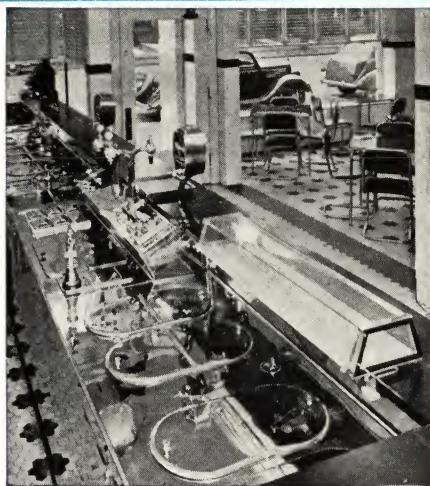
SECTION G-G
Details of Main Entrance



SECTION H-H



BARS AND FOOD EQUIPMENT



3



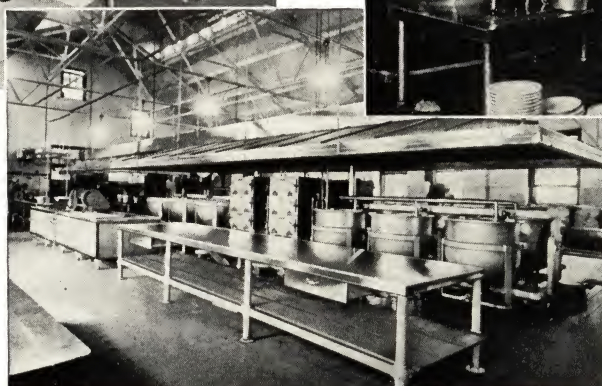
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Enduro has always found one of its most appropriate uses in connection with food service equipment and it was natural that, with the advent of Repeal, Enduro should become a favorite metal for bar equipment. However, the architect's attention is particularly directed to the richly decorative possibilities of Enduro's silvery lustre in modern design. A few typical installations are shown here and many more have been made during the past year. Not only does Enduro meet every requirement of the designer but, for all bar and service equipment such as sinks, tanks, drainboards, counters and table tops, Enduro assures maximum sanitation and permanent resistance to tarnishing, corrosion and general wear.

Whether the conditions called for a material having a beautiful appearance or one which would provide maximum resistance to wear and corrosion or both, Enduro has met every demand with complete satisfaction.

6. **Bus Railways Depot**
Chicago, Ill.
Architects—Graham, Anderson, Probst and White

Enduro is used on this lunch counter for sink and back counter tops and wainscot below the hood. The result is a thoroughly sanitary and most attractive effect.

7. **Slade's Barbecue**
Boston, Mass.
Architect—J. G. Morgan

Steam table, hood over steam table, urn stand table top, and back paneling are made of Enduro.

8. **Byberry Home for the Indigents**
Philadelphia, Pa.
Architect—Philip H. Johnson

Canopies over both the kettles and steamers, ranges and ovens, as well as sinks and cook tables are made of Enduro.

9. **Harrisburg State Hospital**
Harrisburg, Pa.
Architects—Simon & Simon

The 268-inch service counter, steam table pans, covers, knife, fork and spoon wells and coffee urn are all of Enduro.

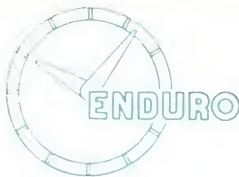
10. **Crystal Bar and Cocktail Lounge, Hotel Onesto**
Canton, Ohio
Designer—Francis A. Onesto

Enduro used for all fixtures behind bar, crimped panels on front of bar, and for foot rail and rails on chairs.



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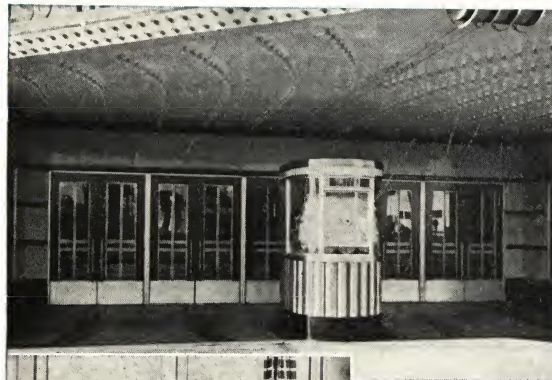
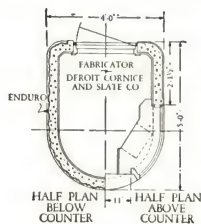
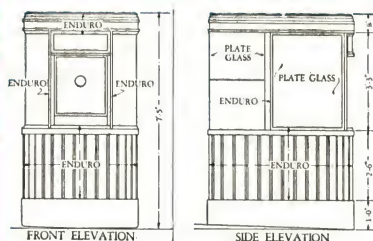
MISCELLANEOUS APPLICATIONS

ENDURO Stainless Steel, because of its versatility, corrosion-resistance, high tensile strength and workability, has been employed for almost every decorative and utilitarian usage. The illustrations on this page (described below) show some of the almost innumerable possibilities this enduring and beautiful metal offers.

Naturally all of the various applications of Enduro do not come to our attention. Perhaps you have seen an unusual usage which has prompted you to specify "ENDURO." If this is the case—we would appreciate your contacting our main office . . . explaining the application of Enduro and where it was employed.

Enduro Stainless Steel, as may be seen in the illustrations, is not confined to exterior applications. Frequently, because of its enduring beauty, Enduro is selected for the fabrication of decorative grilles, railings and interior structural units.

When next you specify Stainless Steel—remember the name "ENDURO."



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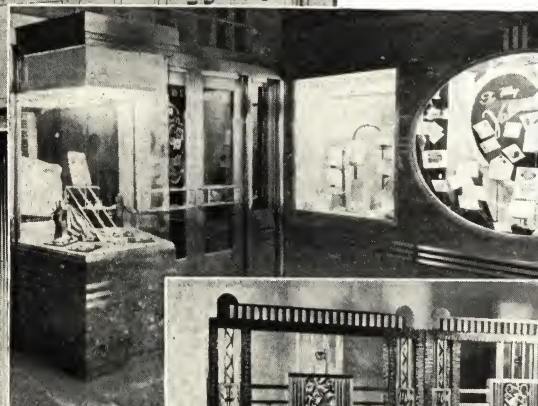
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1-2. Beverly Theatre Detroit, Mich.

Architect—Chas. N. Agree

Enduro used in construction of ticket booth and front entrance to this attractive theatre.

3. Kitchen Sink

Showing Tracy Enduro stainless steel sink and Tracy DeLuxe linoleum top trimmed with Enduro.

4. Hess Bros. (Dept. Store) Allentown, Pa.

Architects—Thalheimer & Weitz

Enduro used for window trim, doors, ornamental trim over entrance doors and lobby.

5. Students' Health Center University of Missouri Columbia, Mo.

Architects—Jamieson and Spear
An elevator cabinet constructed entirely of Enduro for beauty and permanence.

6. Metal Gates for Apartment House, Columbus, Ohio Fabricator—Loeben Ornamental Metal Works, Philadelphia, Pa.

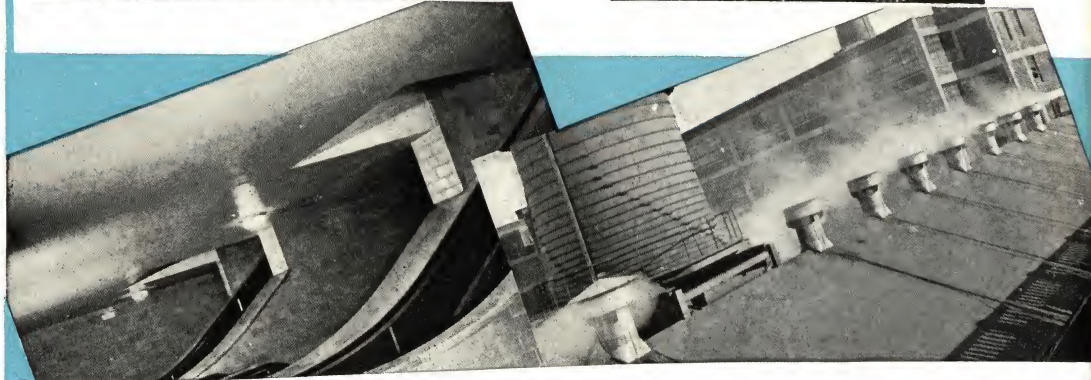
Enduro and Bronze combine to make this beautiful ornamental gate.

7. Pennsylvania Railroad Station, Newark, N. J. Architects—McKim, Mead and White

Enduro used for trim on all escalators—an unusual application.

8. Arcadia Knitting Mills Allentown, Pa. Fabricator—Penn. Ventilator Co. Philadelphia, Pa.

Enduro ventilators, permanent, attractive—corrosion resisting.



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8

ARCHITECTURAL

PORCELAIN ENAMEL



Toncan Iron

enameling sheets

REPUBLIC STEEL CORPORATION



A New Freedom

IN ARCHITECTURAL DESIGN

HAVE you ever wished for a material that would permit full expression of design and color and at the same time provide practicability at moderate costs? Porcelain enamel is one of the most versatile materials ever developed for architectural purposes. No material offers such a challenge to the creative initiative of the architect. It offers a complete range of lasting, permanent colors, embodying delicate tints and shades — in fact no color limitation. Being a vitreous material it is non-porous and non-absorbent and is as easily cleaned as a china dish. It can be supplied in acid-resisting finishes for service in sulphur-laden atmospheres. It has unusual resistance to abrasion not found in plastics or organic coatings. It has almost unlimited possibilities of surface design, and types of finishes. It can be obtained in welded, stamped or drawn shapes. When using a panel system it is lighter in weight than most masonry products and can be quickly taken down, moved and reassembled practically without loss.

AN ANCIENT PRODUCT BECOMES A MODERN BUILDING MATERIAL

Before the dawn of Christianity, ancient artisans found that minerals could be melted together and fused to a metal base. During the next thousand years or so, porcelain enamel was used in the creation of beautiful cloisonne vases, medallions and ornaments of various kinds. The application of porcelain enamel to cooking utensils, plumbing ware, stoves, refrigerators and other household products came as the next logical forward step.

Porcelain enamel first made its appearance in the architectural field in gasoline service station and hamburger stands because of its cleanliness, low maintenance costs and high salvage value.

Today, architectural porcelain enamel is far more than a "novelty" material. New finishes, including the soft matte finishes, new methods of fabrication allowing greater freedom in design, new methods of erection and concealed fastenings, all have combined to make architectural porcelain enamel an accepted high quality building material — one that can be classified as truly modern.

The application of porcelain enamel is steadily expanding into new fields. There are now companies all over the country that specialize in the fabrication and enameling of iron sheets for architectural purposes. Store fronts, theatre fronts and lobbies, gas stations, dairies, even entire department store building fronts of porcelain enamel are almost as familiar as the porcelain enameled kitchen stove and refrigerator.

WHERE ARCHITECTURAL PORCELAIN ENAMEL IS BEING USED

Gasoline Service Stations: Exterior and interior paneling: Signs.

Food Stands: Exterior and interior paneling: Signs.

Bus Stations: Exterior and interior paneling: Signs.

Store Fronts: Paneling: Signs: Lighting Equipment.

Food Industries, such as Packing Houses, Dairies, Breweries, Bakeries, Canning Plants: Interior paneling, walls and ceiling — for sanitation; Exterior paneling — for low upkeep and publicity value.

Laundries: Interior wall and ceiling paneling and doors — to resist steam and alkalis.

Chemical Laboratories: Walls, doors, ceilings, hoods and shelving — to resist corrosive chemical fumes, calcium chloride smudge — to increase light reflection.

Barber Shops and Beauty Parlors: Interiors.

Elevator Cabs and Lobbies.

Hospital Operating Rooms: Doors, ceiling and wall paneling.

Hotel and Restaurant Wash Rooms: Walls, ceilings, doors, toilet stalls.

Theatre Fronts and Lobbies.

Dental and Medical Offices.

Kitchen and Bathroom Walls and Ceilings.

Office Buildings: Wainscoting.

Miscellaneous Uses: Shower bath stalls, toilet stalls, partitions for beauty parlors, hospitals, etc., shelving, restaurant table tops, formed steel plumbing fixtures, refrigerator display cases, counters, fruit and vegetable stands, kitchen cabinets, light reflectors, bar equipment, soda fountains, blackboards, kick plates, push plates, fireplaces, telephone booths, desk tops, spandrels of office buildings, prefabricated splashers panels for plumbing fixtures.

Republic Steel
CORPORATION
GENERAL OFFICES . . . CLEVELAND, OHIO

What is

ARCHITECTURAL PORCELAIN ENAMEL?

Porcelain enamel is an inorganic material. It is made of several minerals fused together at a high temperature. This enamel is then ground up into powder and fused again upon a ferrous metal base. Because it is inorganic, it does not fade and is impervious to moisture, being non-absorbent. This tough, glass-like coating is not affected by weather or light. Recent developments have led to the production of acid-resisting porcelain enamel which repels the attack of ordinary acids which might be encountered in building service or in the atmosphere.

IMPORTANCE OF TONCAN IRON ENAMELING SHEETS

To meet the requirements of modern architectural applications of porcelain enamel requires a high grade sheet. The physical properties of the sheet are, of course, of an importance equal to its ability to accept a satisfactory coating of porcelain enamel. The widespread use of enameled products prior to their application in the architectural field has involved some of the most difficult fabrication operations which are encountered anywhere in the use of sheet metal.

Experience of many years has demonstrated that open hearth irons are most suitable for porcelain enameling. Toncan Iron is one of the oldest open hearth irons in the market, having been produced for thirty years. Toncan Iron Enameling Sheets, therefore, combine the physical properties required for difficult fabrication and the ability to accept a high grade coat of porcelain enamel.

Before and after enameling, Toncan Iron Enameling Sheets are unusually flat, free from waves and buckles and, in addition, have the highly desirable properties of an open hearth iron for enamel adherence and for freedom from segregated impurities which might react with the porcelain enamel.

Constant research is conducted by Republic in an effort to keep Toncan Iron at all times suitable for all types of porcelain enamel. Close cooperation with the manufacturers of frits, as well as with those plants which produce their own frit, enables us to work out with the enamer any problem in connection with the use of our product.

METALLURGICAL and ARCHITECTURAL SERVICE

Republic Steel Corporation maintains a special engineering and research department devoted to the development of enameling iron. Another department in the Product Development Division is devoted to the study of the application of porcelain enameled iron. Republic engineers are ready to assist architects and designers in the selection of the proper type of porcelain enamel construction for any specific job. For further information regarding this service, write direct to the main office or any of our district offices.

Typical Porcelain Enamel Installations

(Cover) Cole's Shoe Store, Cleveland, Ohio.

Architect—W. Emil Forman, Edison Stores, Inc., St. Louis.

Enameling by—Davidson Enamel Products, Inc., Lima, Ohio.

White Porcelain Enamel in fluted columns on either side of a section of yellow marble. Connecting the two columns at the top is another series of panels trimmed in brown. Ceiling of marquee and entrance is white.

1. A bathroom in an Oakland, California home.

Enameling by—Ferro-Enameling Company of California.

This shower bath is made with a one-piece receptor fabricated, welded and enameled with non-skid porcelain. The walls, corner pieces and threshold are also of Ferro Enamel.

2. Residence, 32 E. 74th St., New York City.

Architect—Howe & Lescaze, New York City.

An unusual treatment of facade work for the front of a modern residence. The left curved fascia is in battleship grey and the right vestibule return wall, in blue. The method of construction employs dove-tail joints throughout.

3. Municipal Light Water Power Plant.

Enameling by—U. S. Porcelain Enamel Co., Los Angeles, Calif.

Installation by Luminous Structures.

An extremely modern and interesting application of porcelain enamel. It illustrates the adaptability of porcelain enamel to any design.

4. A Unit Kitchen of Modern Design.

This kitchen installation includes sink, base cabinets, dishwasher, range and refrigerator. The enduring beauty of porcelain enamel adds to the attractiveness of this practical kitchen.

5. Executive Office, Chicago Vitreous Enamel Product Company, Cicero, Ill.

Architect—Harold R. Zook.

This room is an outstanding example of the dramatic possibilities for using porcelain enamel effectively for interior walls and for furniture.

6. U. S. Post Office, Audubon and 165th St., New York City.

Architect—M. Dewey Foster, New York City.

Enameling by—Toledo Porcelain Enamel Products Co., Toledo, Ohio.

An interesting application of porcelain enamel in a government building where durability is of prime importance.

7. Esso Gas Station, Erie, Pa.

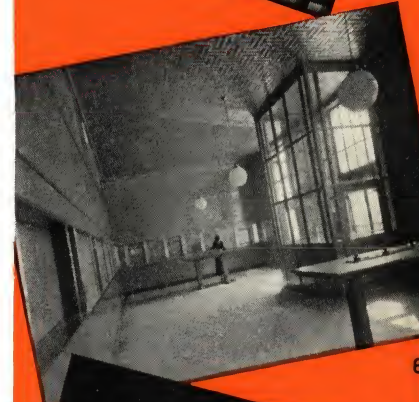
Enameling by—Erie Enameling Co., Erie, Pa.

A really beautiful gas station, attractive day or night because of its gleaming smartness. Porcelain enamel pays dividends to gas station owners.

8. Cushman Bakers Store, Chicago, Ill.

Enameling by—General Porcelain & Mfg. Co., Chicago, Ill.

Porcelain enamel is ideal for food stores. Its sparkling beauty is the acme of cleanliness, its ease of maintenance a joy to owners.



Enameling Terms* for THE ARCHITECT

Acid-Resistant: Resistant to acids although not necessarily stain-proof. An enameled surface is generally considered acid-resistant if, after being exposed to the action of 10% citric acid solution for 15 minutes, it does not become "chalky."

Adherence: The ability of an enamel to stick to or bond with a given metal surface.

Application: The act of depositing a coating of enamel on a prepared metal surface.

Base Metal: Enamellers, referring to base metal, usually mean the sheet iron or cast iron metal base to which enamel is applied.

Blackboard Enamel: A special type of black enamel designed to give a matte surface finish to blackboards.

Black Edging: A further coat of enamel applied to the fired or unfired ground coat around the edges of the article thus producing an edging blacker than the ground coat.

Blank: A term widely used in sheet metal working to denote the piece cut from the sheet that is to be used in forming the finished article. The blank ordinarily contains exactly the right amount of metal to form a piece of the desired size. The operation which consists of punching the blanks from the original sheet of metal is called blanking.

Burning: Referred to in the enamel industry as the process of fusing vitreous or porcelain enamel on a metal surface.

Burning-Bars: Equipment, usually of heat resisting alloy construction, used for suspending or supporting articles during the fusion of the enamel coating. May be obtained in numerous sizes and designs to best suit the particular type of enamel ware.

Chipping: A spalling or breaking off of the enameled surface in flaky varied size pieces. A defect which can be avoided by proper care in handling, processing, etc.

Cleaner: Usually a mixture of alkalis reinforced with other ingredients and used at a concentration of 6-8 oz. per gallon at a temperature of about 200-212 degrees F. in the pickle room to clean rust, grease and dirt from metal parts prior to enameling.

Color Oxide: A mixture of inorganic materials used in the mill addition to color porcelain enamels.

Cover Coat: A porcelain enamel coating applied over the ground coat and from which it usually differs in color.

Crazing: Almost invisible lines in a finished enameled surface, extending down to the base metal. This condition should not be confused with "Hair-lines."

Crimping: An operation wherein the metal around or along the edge of the piece is shaped into the form of a roll or curl.

Decalcomanias or Decals: Are designs printed on tissue paper in refractory enamel colors rather than in ordinary printer's ink. These designs may be transferred to a burned enamel surface and fired thereon becoming an integral part of the coating.

Drawing: Drawing proper consists in cupping a blank (that is, taking a sheet metal blank and producing a cup-like shape) during which process a flowing of the metal takes place.

Durability: The lasting qualities of an enameled surface.

Edging: The process of removing dried cover coat from the edge of a piece of ware to expose an underlying enamel. Edging may also denote the application of colored enamel to the edge after brushing.

Egg-Shell Finish: An enameled surface similar in appearance to the shell of an egg. A desired physical condition in some ground coats.

Finish-Coat: A term often used to designate the final coating of enamel.

Flange: A projecting rib or rim, for strength, as a guide or for attachment to another object.

Flecked: A variation in the solid color secured on enameled ware by mixing into an enamel, sized particles of frit of a different color.

*Reproduced by permission of the Ferro Enamel Corporation

Typical Porcelain Enamel Installations

1. Ohrbach's Store, New York City.

Architect—J. M. Berlinger

Enameling by—Porcelain Metals, Inc., N. Y.

This beautiful store was designed to emphasize immensity. Ivory and green are the predominating colors which create a very pleasing appearance.

2. Ferro-Enamel Company, Reception Room, Oakland, Calif.

A colorful and interesting lobby, counter front, sign and wall panels are porcelain enamel. The whole floor is veiled over with a brownish enamel which is non-skid. Color samples are held in place with stainless steel clip strip.

3. Taxpayer, 79th St. and Lexington Ave., New York City.

Architect—Wm. J. Hohauser.

Enameling by Porcelain Metals, Inc., N. Y.

The entire parapet wall, spandrel and bulkhead are porcelain enamel; colors are tan, green and black. The upper fascia is constructed with the lock joint system, trim is stainless steel.

4. Kitchen's Tire Service, Erie, Pa.

Enameling by—Erie Enameling Co., Erie, Pa.

An attractive service station of porcelain enamel. While service stations were one of the earliest uses for porcelain enamel modern developments have added greatly to the attraction value and pleasing appearance.



Enameling Terms for THE ARCHITECT



Frit: Small, friable pieces of enamel glass resulting from the quenching and shattering of the molten enamel as it is discharged from the smelter into tanks containing cold water.

Fusion: The union or blending of enameling ingredients with the base metal or previously fired enamel coating to produce a uniform surface using heat as the medium.

Gloss: A term used to designate the shine or lustre of a smooth enameled surface.

Graining: The production of an enamel finish resembling wood grain. Similar to the printing of small etchings except that the ink is picked up from the etched plate on a special roller and transferred to the enamel surface to be grained.

Ground Coat: A coat of enamel applied directly to the metal surface and differing in composition from the cover coats to be applied later.

Hair-Lines: Hair-Lines are lines appearing in an enameled surface, which are slightly depressed below the surface in the shape of a groove and not extending to the base metal. In white enamel the lines appear white, but in colored or dark enamels, the lines nearly always appear darker than the surrounding surface.

Lustre: The pearly or silky appearance of an enameled surface.

Marble-ized: An enameled surface color-grained to give the appearance of variegated marble. The color may be applied on either the fired or unfired enamel ware.

Matte: A slightly roughened surface almost, or entirely lacking in lustre.

One-Coat Work: One coating of enamel; ground coat only or finish enamel directly on the metal. In refrigerator and stove sheet iron work, one coat of cover enamel over ground coat is often called "one coat work."

Opacity: The degree of whiteness of a white enamel, calculated by its ability to cover black or blue-black ground coats.

Pickling: The practice of cleaning sheet steel to properly prepare it to receive the enamel coatings.

Printing: Printing on the enamel is done with a rubber or composition stamp having raised letters or design. The ink for this work is composed of a suitable mixture of oils as a vehicle and a ceramic printing oxide.

Semi-Matte Finish: An enameled surface not altogether rough to the touch but having a slight glossy appearance may be known as a semi-matte finish.

Semi-Transparent: An enamel glaze which is partly opaque and not totally transparent. May also be known as semi-opaque enamel.

Shading: A pleasing effect produced in enamel by applying, usually by spraying, an area of dark enamel to a lighter background, the thickness being tapered off in one or more directions.

Sign Enamel: A brilliant high gloss enamel particularly adaptable for sign work.

Speckled Ware: An enamel finish having a background of uniform color into which an enamel of different color or shade is applied in very small specks.

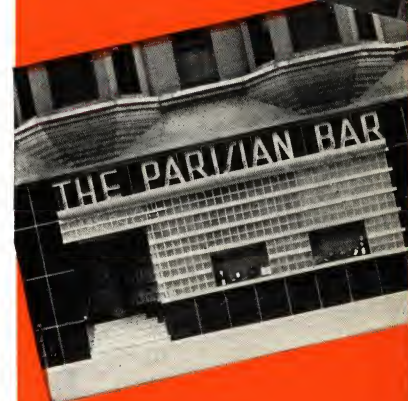
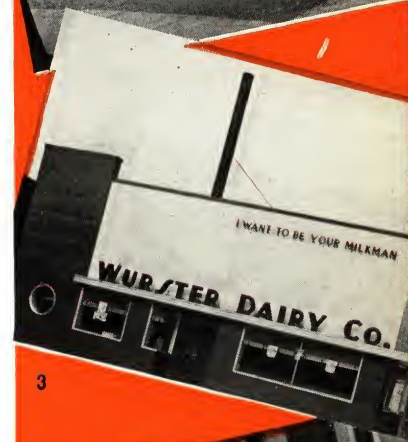
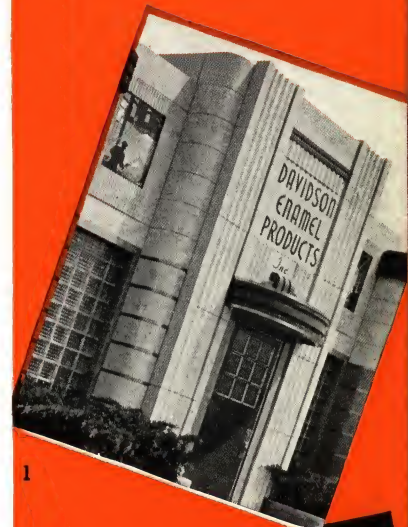
Stain-Proof: An enameled surface is considered "stain-proof" if it is not stained, discolored or otherwise affected by acids (except Hydrofluoric), chemicals, dyes or fruit juices, under atmospheric conditions.

Stencil: A design which may be cut from either cardboard or sheet zinc and placed on the dry enamel coating. A stencil brush is used to remove the dry enamel from the stencil openings.

Two-Coat Work: Enamel ware which has two coats of enamel on the metal, usually one ground coat and one cover coat. Many enamellers refer to two cover coats over a ground coat on sheet iron as "two-coat work" although the buying public refer to it as triple coated ware.

Typical Porcelain Enamel Installations

1. Davidson Enamel Products, Inc., Lima, Ohio.
This manufacturer of porcelain enamel has designed and built his entire building of porcelain enamel. The application of stainless steel trim has added to the effectiveness of the general design.
2. Kewpee Hotels, Toledo, Ohio.
Enameling by—The Toledo Porcelain Enamel Products Co., Toledo, Ohio.
The use of porcelain enamel for the construction of hamburger stands is well known. It gives an extremely attractive appearance and is easy to keep clean. The stainless steel trim sets off the porcelain enamel to advantage.
3. Wurster Dairy Company, Ann Arbor, Mich.
Architect—Ralph W. Hammett.
Enameling by—The Toledo Porcelain Enamel Products Co., Toledo, Ohio.
4. Parisian Bar, Hotel Hollenden, Cleveland, Ohio.
By Maul Macotta Corp., Detroit, Mich.
Porcelain enamel, glass block and stainless steel have been effectively combined in this interesting front of modern design.





FABRICATING THE PANELS

Sheets for porcelain enameling work usually are fabricated in the enameling shop. Drawings with accurate dimensions are necessary since all panels are prefabricated and must fit together on the job. As a general rule, No. 16 or 18 gauge sheets of enameling iron are used, but No. 20 gauge may be employed if the finished panel is carefully backed up or veneered.

Before enameling the sheets are sheared, bent, drawn and punched in the usual manner. These sheets may also be fabricated into special shapes such as flutings, reedings, louvres, etc. Usually the holes in the panel are of predetermined size and location and are punched or cut in the panels before enameling. However, in emergencies the holes can be sawed through the finished porcelain enameled panel on the job by means of a portable, electric ceramic hole saw.

As a general rule, all connections are welded, including flanges, clips, corners, etc. These are then filed smooth before all dirt and grease is removed from the sheets. The sheets are then pickled in acid to remove rust and scale.

ENAMELING THE PANELS

Following the pickling process, which prepares the surface of the panels for bonding with the porcelain enamel, they are given a dark colored base or ground coat. This ground coat is applied either by dip or spray process. This coat is so compounded that it has an affinity for and fuses with the metal itself. Successive coats are usually sprayed on. Each coat is fused in a furnace at 1500 to 1550 deg. F. A standard enameling furnace accommodates panels up to about 4 x 10 ft., thus limiting the size of panels that can be safely fired. Following the applications of the porcelain enamel, all sheet are carefully inspected for imperfections.

For all exterior work, acid-resisting enamels should be specified. Porcelain enamel is available either in glaze, semi-matte or matte finishes; the latter two types having fewer high lights and reflections than are found in a glaze finish. Texture can be obtained by covering a glaze enamel with a semi-matte enamel of the same color and stencilling an appropriate design so that the glaze enamel shows through in a pattern. Stippled effects and designs printed by means of screen process can also be obtained.

TYPICAL PORCELAIN ENAMEL INSTALLATIONS

1. Joseph A. Schwarz Store, New York City.

Enameling by Vesco Sales Corp., New York City.

Facia is buff with sign backing, valance, pilasters and bulkhead of chocolate brown.

2. Portable Bar for a Recreation Room.

Built by Maul Macotta Corp., Detroit, Michigan.

Porcelain Enamel is an ideal material for this use because it is easily cleaned, made in bright colors and may be decorated as desired.

3. Socony Vacuum Oil Co., Cleveland, Ohio.

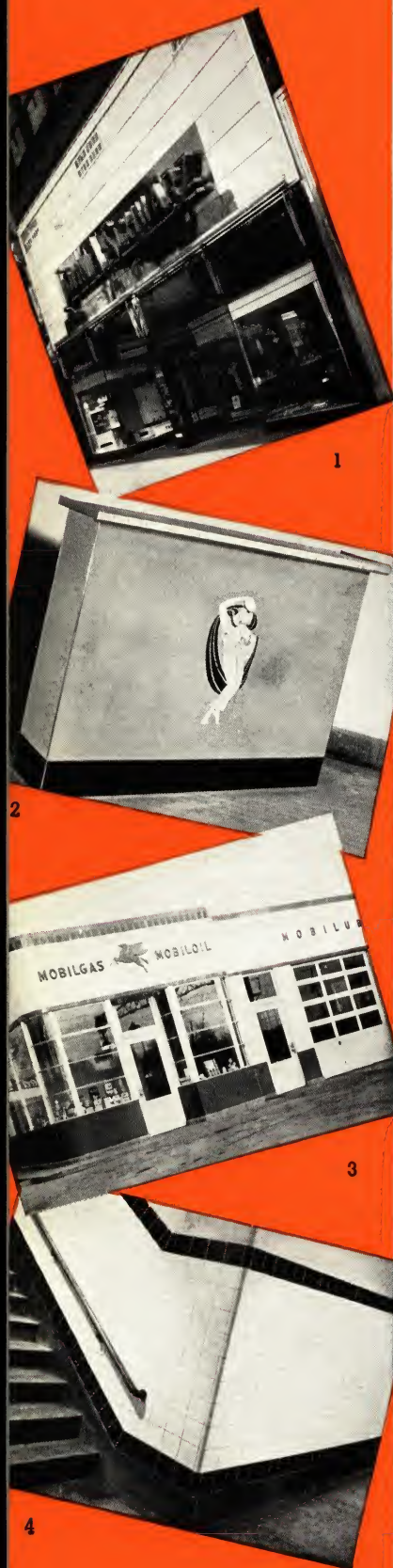
Manufactured and erected by Service Station Division, The Austin Company, Cleveland, Ohio.

Background is white, base, coping and letters red porcelain enamel. Fluted effect on coping produced by shading the enamel.

4. Pedestrian Tunnel, Boston, Mass.

Enameling by Wolverine Porcelain Enameling Co., Detroit, Mich.

Porcelain Enamel provided light, clean, non-breakable wall finish.



SUPPORTING STRUCTURES AND INSTALLATION of PANELS



For remodeling work where the panel type of construction is used, the old structures are frequently leveled off with wood or metal furring strips located where the panel joints are to be. Care should be exercised to insure an accurate spacing of the furring strips and a level support for the panels.

On new buildings, if the supporting structure is to be masonry or wood studding, it is necessary that extra caution be taken to hold supporting structures to accurate dimensions and to keep the buildings plumb.

Steel frames are being used for small buildings such as gas stations, food stands, etc. These frames are often made of light gauge "U" channels welded into rectangular sections. These rectangular sections are bolted to the foundations and fastened together on the job (see cuts 3 and 4). These steel frames offer a dependable, accurate, supporting structure for the prefabricated porcelain enameled panels.

When interlocking panel systems are used, the starting points and the end points must be determined for the fastening of the panels to the supporting structure. In remodeling work where custom fitting is involved, each panel should be numbered on the drawing and this number marked on the back of the panels before shipping.

On certain types of construction, the caulking operation can be simplified by "buttering" the flanges of the panels with a knife grade caulking compound. When the panels are fastened in place, the excess caulking is squeezed out and can be trimmed off with a tuck-pointing tool.

Systems of Construction

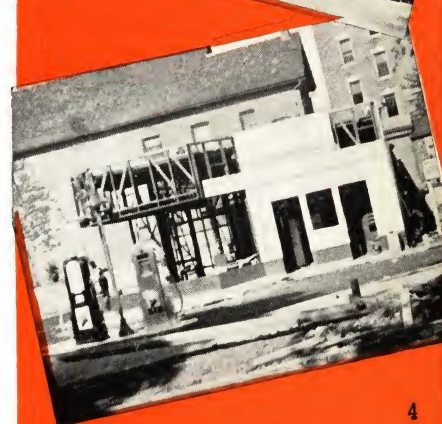
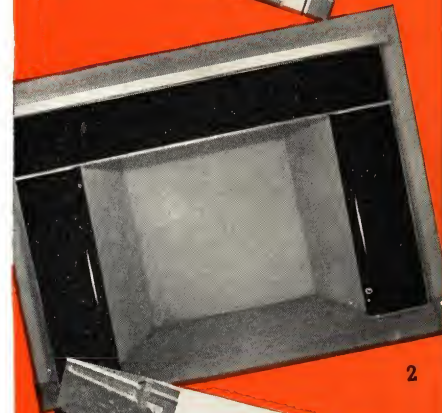
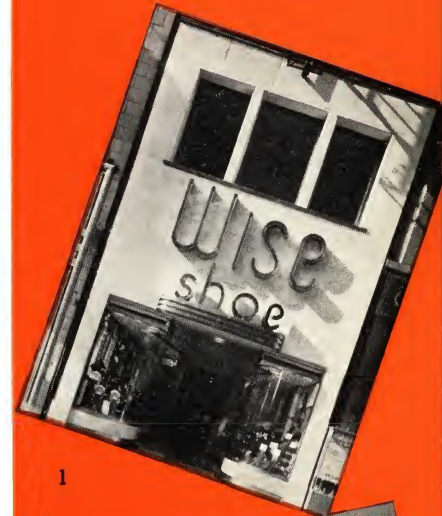
There are two general types of construction employing porcelain enamel materials: the load-bearing type and the sheet or panel type. Both types are widely used and their use depends upon the conditions to be met, designs required, cost, etc.

On the following pages are shown details of several of the more commonly used systems of constructions. These are not the only practical systems, however, but are typical of the meritorious devices which are constantly being developed.

In the load-bearing type, porcelain enamel sheets or fabricated forms are backed with light weight, load-bearing, concrete units. The panel edges may be trimmed with narrow stainless steel edging to protect these edges from corrosion or the panel may be flanged on all sides. In the sheet or panel type of construction, the porcelain enamel sheets are anchored to a supporting construction by various methods. Some of those in more common use are shown on the following pages.

TYPICAL PORCELAIN ENAMEL INSTALLATIONS

1. Wise Shoe Store, Detroit, Mich.
Enameling by Erie Enameling Co., Erie, Va.
2. Mantel for Fireplace.
Built by Maul Macotta Corp., Detroit, Mich.
3. Frame for Filling Station.
Built by Dressen Engineering Co., Tulsa, Okla.
Steel members in place ready to apply the porcelain enamel sheets.
4. Same Station as above.
Porcelain Enamel Sheets partially in place.



Systems of Construction (CONT'D)

The danger of warpage in porcelain enameled panels can be reduced greatly by using heavy gauge sheets of enameling iron and by keeping the panel sizes within certain dimensions. Fluted and heavily embossed panels usually have enough rigidity to prevent any noticeable warpage.

The normal warpage in porcelain enameled panels can be removed *after* the panels are enameled by backing up the panels with concrete, plywood, or insulating boards. This backing on the porcelain enameled panels has the additional advantages of removing metallic sound, reducing the transmission of sound, providing insulation against heat and cold, as well as preventing "sweating" on the back of the panels.

When backing up the panels with insulating board or plywood, the material is usually veneered to the panel under pressure, using water-proof caseine glue or synthetic resins as adhesives. It is necessary as in the case in most veneered constructions to balance the veneering with another piece of steel on the back of the insulating board or plywood.

Republic Galvannealed Sheets of 26 or 28 gauge are a good material for this purpose. A

galvannealed sheet is one which is hot dipped galvanized in the customary manner but which, before cooling, is annealed. Thus, the protective zinc is made to combine with the steel sheet. The silver matte surface of the galvannealed sheet is a series of zinc-iron alloys bound to the sheet because it is an integral part of the sheet. The zinc coating prevents a chemical reaction from taking place between steel and adhesives. This galvannealed sheet is a better sheet for veneering than is a galvanized sheet because the porous, matte-surface of the galvannealed sheet assures a mechanical bond uniformly stronger than the smooth, greasy surface of the galvanized sheet.

Of the many types of caulking compounds that have been tested, those that contain slow drying oils such as tung oil or China wood oil and long Canadian asbestos fiber, seem to have the longest life, adhering to the porcelain enamel the best and remaining plastic the longest, thus taking care of the thermal expansion of the porcelain enameled panels.

For interior uses, especially between panels on working surfaces a self-vulcanizing rubber putty has been found to bring good results. One of these is made by a leading rubber company and is called "Plastikon Putty."

ROSETTE SYSTEM

Simplicity of fabrication and erection, combined with light weight, makes this a very practical system for ceilings where cleanliness is an important consideration. It is suitable for either new work or for use over old ceilings.

Flat furring strips spaced on centers equal to the size of the panels to be used are fastened to the

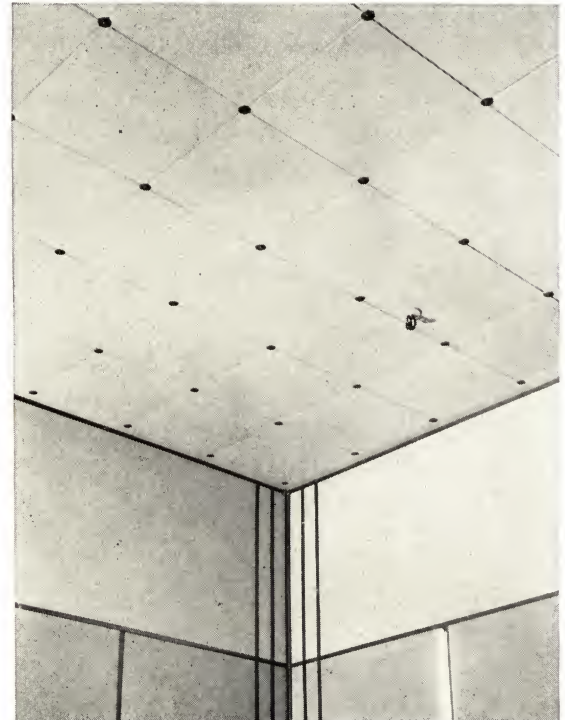
supporting structure in both directions.

Panels are formed with flange on four sides to form a key for caulking and may be veneered with insulating board for sound deadening.

Panels are held in place by rosettes screwed or nailed to the furring strips at the corners.



Furring strips in place ready for applying the panels.



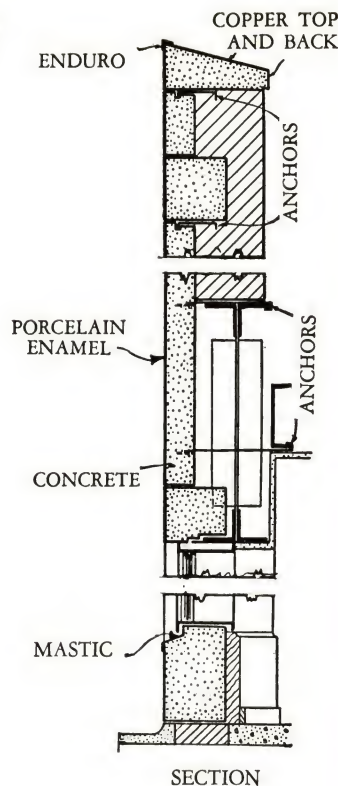
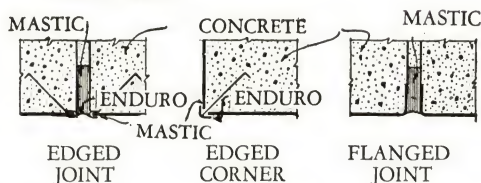
Finished ceiling showing rosettes holding the panels.

MACOTTA LOAD-BEARING SYSTEM



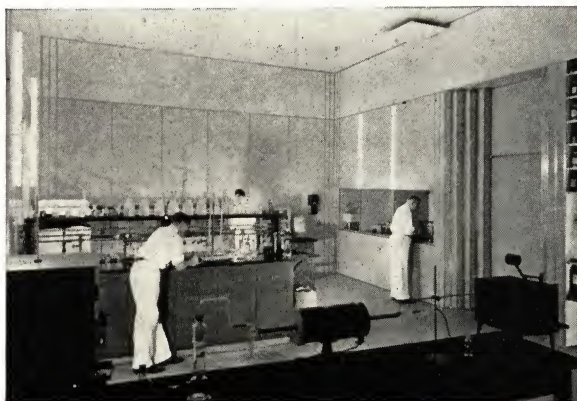
Riviera Theater, Port Huron, Michigan
Fabricated by Maul Macotta Corp.,
Detroit, Mich.
Enameling by Wolverine Enameling Co.,
Detroit, Mich.

Macotta is a load-bearing, fire-resisting structural unit. It consists of a slab of light weight concrete faced with porcelain enamel joined into one solid unit of any desired thickness. The enamel facings are supplied either with protective stainless steel edges or with enameled flanges. It is set on a mortar bed in a manner similar to limestone or other masonry units.



SNAP-ON MOULDING SYSTEM

This system is used chiefly on interior work. Stainless Steel mouldings may be used as a part of the design. When run vertically they impart a feeling of height, and when run horizontally one of spaciousness. The mouldings are in two parts. The lower portion or track is fastened to the wall or furring strip by screws and overlaps the edges of the panels holding them securely. When in place the cover or finish moulding is snapped in place. In chemical, food and beverage plants and wherever sanitation is important the strips



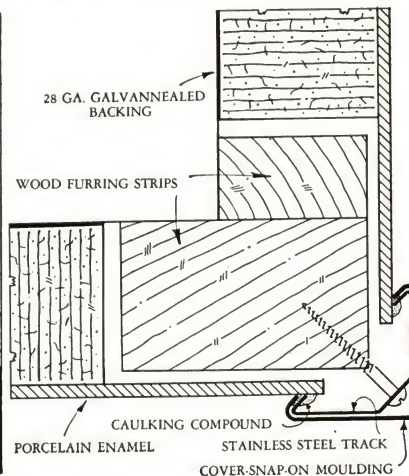
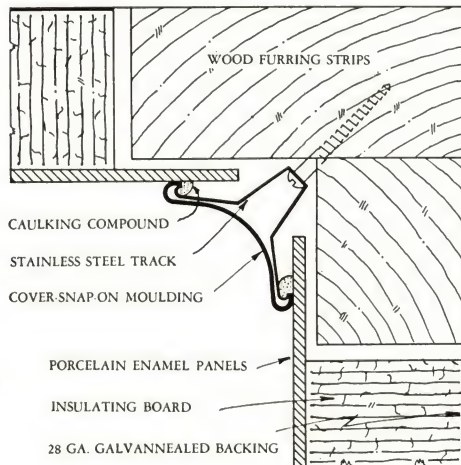
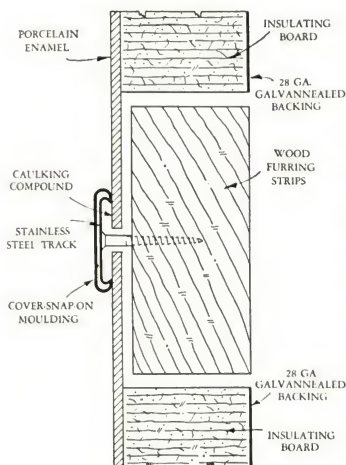
Laboratory of Chicago Vitreous Enamel Product Co.

Harold R. Zook, Architect.

The walls, ceiling, door, shelving and exhaust hood are all porcelain enameled. Panels are held in place by snap-on mouldings.

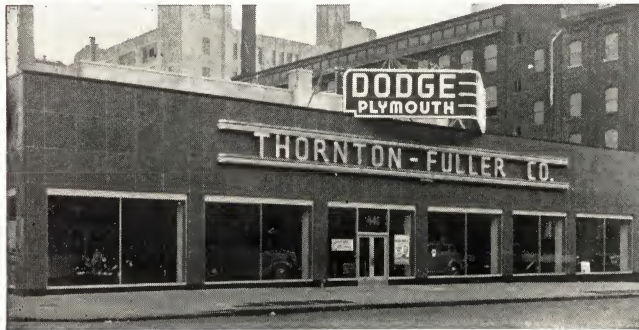
tion is important the strips should run vertically so that water used in washing the walls will not settle in the joint. Where the walls are to be washed frequently, caulking compound is placed between the track or lower portion of the moulding and the panel. Where special flatness is important the sheets should be backed with insulation board with Republic Galvannealed Sheets on the reverse side.

The sheets do not interlock and any panel may be removed without disturbing the others.



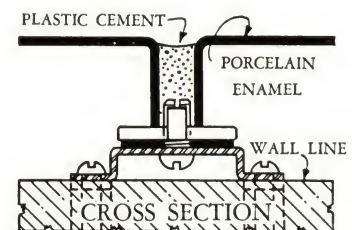
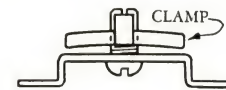
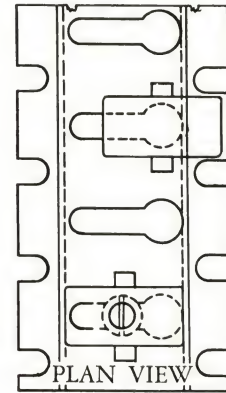
METAL FURRING STRIP AND SCREW CLAMP SYSTEM

A special metal furring strip is used in this system in place of the wood strips used in many systems. These strips are secured to the wall by screws in the slots on the sides. Panels are fastened to the strips by means of special screw clamp, which extends through slots in the sides of the panels. Head of the screw is slipped into the keyhole slot in the furring strip and tightened by a slot for screw driver in the end of the screw. Clamps are single or double used at border panels or adjoining panels respectively. Joints are filled with mastic or may be covered with "snap-on" metal moulding which is held by a special stud. An extension bracket is used to line up irregularities in the under surface.

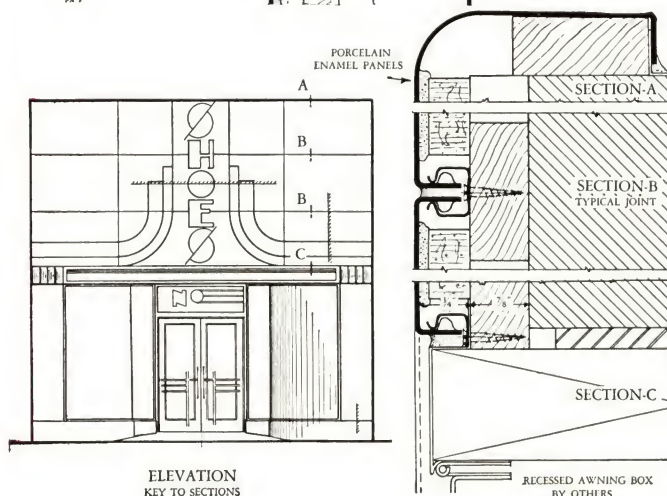
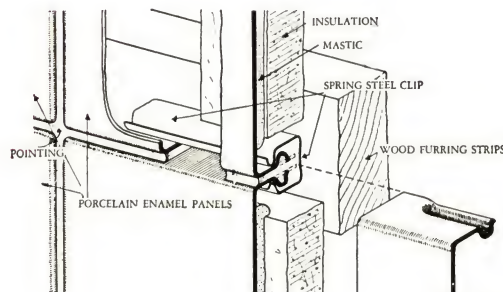


Thornton-Fuller Building, Philadelphia, Pa.

Faced with porcelain enameled sheets applied by the metal furring strip and screw clamp system. Detailed and erected under supervision of the Enamel Products Co., Cleveland, Ohio.



SPRING CLIP SYSTEM



This is a non-interlocking system and any panel may be removed without disturbing adjacent panels. Indentations in the flanges of the panels snap over special spring clips which have previously been fastened to the wall. The clips give a floating panel construction which allows for expansion and contraction and for absorbing vibration shocks. For exterior work the joints are filled with mastic. For interior work the joints are narrow and require no filler.



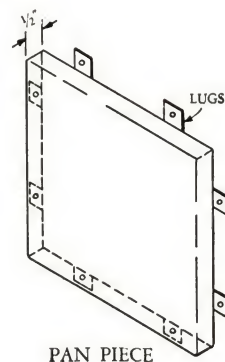
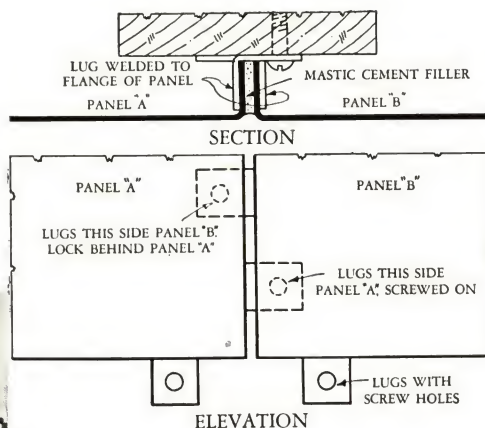
PAN AND LUG SYSTEM

Lugs are welded to each side of the panel before enameling. After one panel is fastened in place by screws through the lugs, those on the adjoining panel are interlocked under the edge of the first panel and the other sides held by screws. On exterior work the joint is filled with mastic. On interior work the joints may be made so narrow no filler is required. This simple system is used largely on remodeling work.



Fleetwing Service Station, Cleveland, Ohio

The old building at the right was remodeled and enlarged into the above modern station by the use of the pan and lug system of paneling fastened to wood furring strips. By means of curved panels and stainless steel moldings, the two sections were made to blend into a unified building mass. Note the reeded door pilasters of stamped and enameled sections. Enameling work by Erie Enameling Co., Erie, Pa.



HANGING HOOK SYSTEM

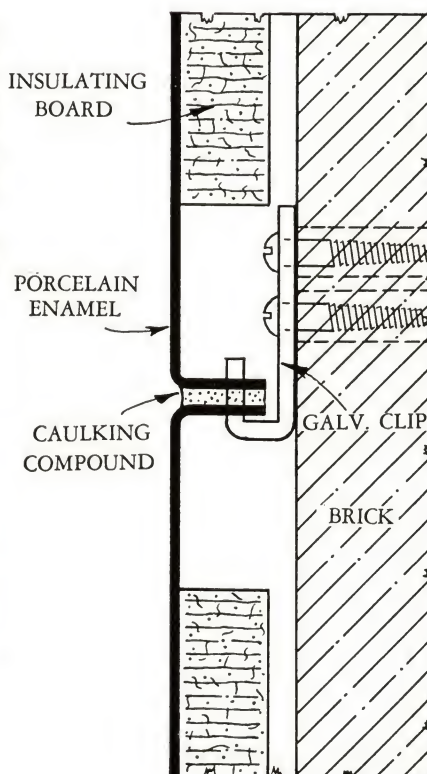
The edges of the sheets are turned back $\frac{1}{2}$ inch and slotted at intervals. Galvanized clips are fastened to the building and the panels hung on the clips which fit through the slots in the panels. Washers may be placed over the hook between the edges of the sheets to insure uniform width of joints, which are approximately $\frac{1}{8}$ inch, filled with mastic. This renders them watertight, prevents vibrations and allows for expansion and contraction caused by temperature changes. The panels may be veneered to a backing of $\frac{1}{2}$ inch insulation board and 28 ga. Republic Galvannealed Sheets to make them flat.

A variation of the construction shown uses a screw through the horizontal part of the hanger. Slots in the sheets fit over the screw and threaded washer is screwed down to clamp the sheet.



Philco Radio Salon, Chicago, Ill.

Porcelain enamel eliminated frequent and costly repainting and gave an attractive, modern exterior here. Note curved and reeded sections at door and small window. Colors light blue gray and maroon. Panels veneered with $\frac{1}{2}$ " Celotex and Galvannealed sheets. Designed and constructed by Federal Electric Company, Chicago, Ill.



LOCK JOINT SYSTEM

This lock joint construction makes it possible to attach the panels directly to the old walls without the use of furring strips, adding only about $\frac{3}{8}$ " to the old walls.

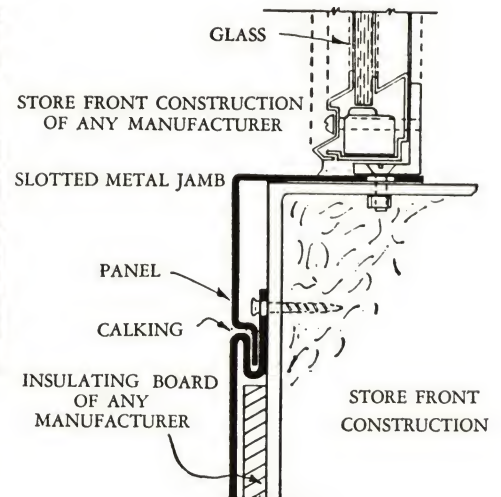
The edges of the panels are formed to dovetail together as shown. The lower panel is fastened to

the building by screws on wooden structures or expansion bolts on concrete. The next panel is then dovetailed into the first. The joint is filled with mastic which not only makes it watertight but also prevents any vibration. As the joints are narrow only a small amount of mastic is required in this system.



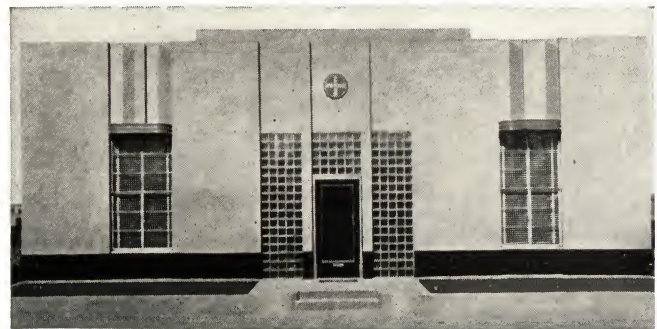
Columbia Drug Store, Washington, D. C.

The lock joint system here solved a difficult problem of modernization. The building was already 2" over the building line and the building commission refused to allow further encroachment on the sidewalk until it was explained that the porcelain enameled panels would add only $\frac{3}{8}$ " to the walls. Fabrication and enameling by Toledo Porcelain Enamel Products Co., Toledo, Ohio.



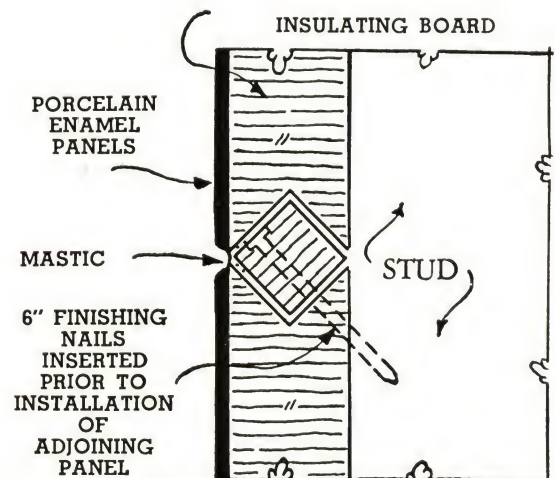
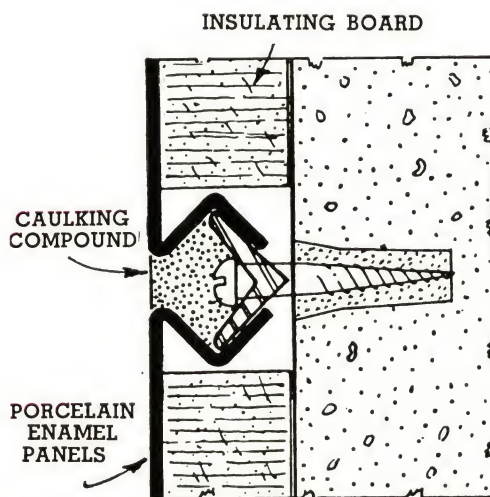
VEE CLAMP SYSTEM

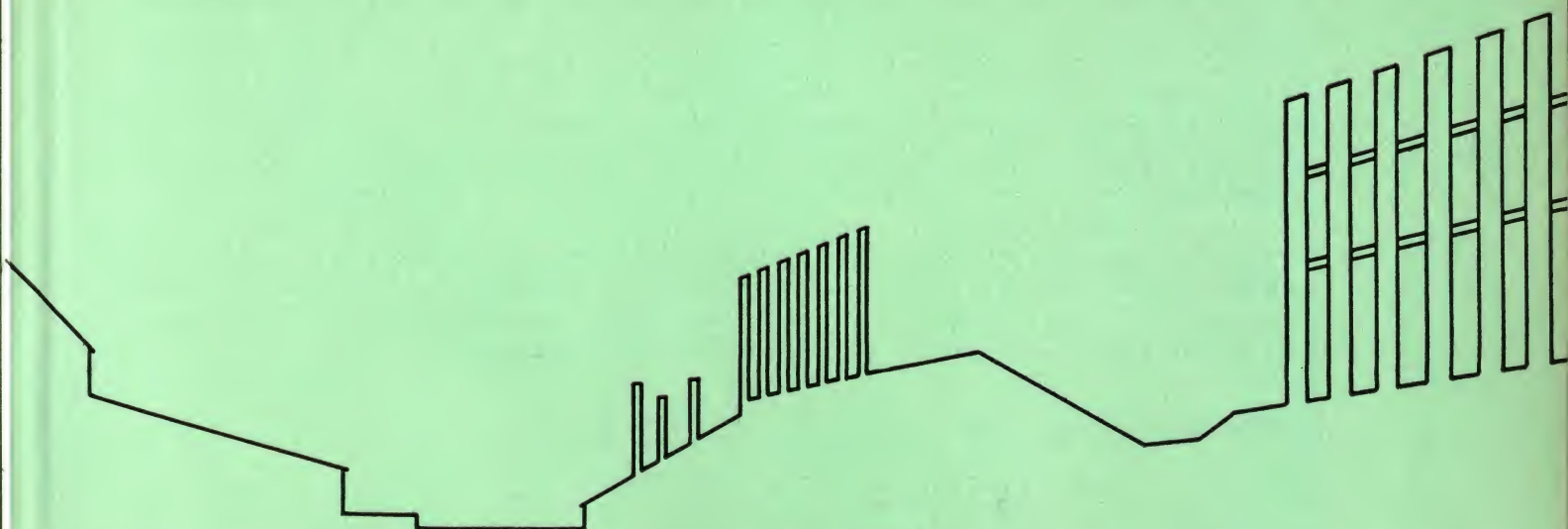
On concrete structures the edges of the panels are formed to fit under the sides of a special vee clamp which is secured to the structure by screws which are tightened into expansion plugs after the panels are in place. The joints are then filled with caulking compound. On wooden structures a square strip of wood is fitted into a recess in the edge of the insulating backing sheets. The strips are nailed to the structure before the adjoining panel is set in place after which the joint is filled with mastic.



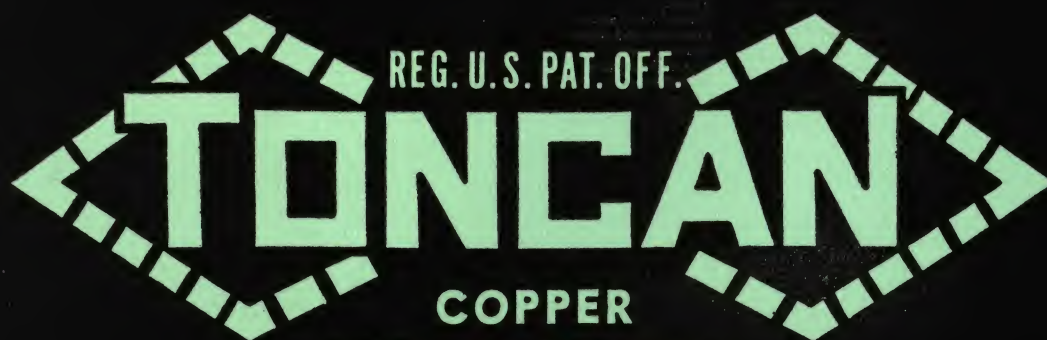
Office Building, Ferro-Enameling Company, Oakland, Calif.

Sheets applied by the Vee clamp system. An impression of depth was created by using two tones of one color to obtain the illusion of shadows in the wall panels above the windows.





REPUBLIC



REG. U.S. PAT. OFF.

TONCAN

COPPER
MO·LYB·DEN·UM

IRON



What is TONCAN IRON?

As originated over 28 years ago, Toncan Iron was a highly refined iron, unalloyed with other elements but containing a minimum of rust-promoting impurities. Subsequent changes resulted from continuous research and relentless testing. Copper, in proper proportion, was alloyed with iron to form a new iron-copper alloy which was more resistant to rust than the original iron. Then followed the addition of molybdenum which produced an iron-copper-molybdenum alloy with resistance to rust never before attained. Experience has demonstrated that neither copper nor molybdenum alone can contribute its full individual properties to the iron—it is only through the addition of *both* in correct proportion that these can be realized. Such is Toncan Iron of today . . . an open hearth iron, scientifically refined to reasonable limits, in which not less than .40% copper and .07% molybdenum are uniformly dissolved . . . an alloy with a proved superior resistance to rust among the ferrous metals in its price class. Time and tests have conclusively proved that Toncan Iron brings to users of *sheets, plates, finished products, and pipe*, certain outstanding advantages which are briefly enumerated on the following pages.

HOW TONCAN IRON COMBATS RUST

Toncan Iron is a rust-resistant ferrous material chiefly because it is an alloy of iron, copper, and molybdenum—the alloy that possesses the most inherent resistance to solution, and hence to rust, of any commercial ferrous material in its price class—the alloy that is most noble, and hence most rust-resistant.

Toncan Iron is rust-resistant also because it is chemically uniform. Chemical uniformity is essential for maximum rust-resistance, as otherwise chemical differences would create electropotential differences which hasten the rate of solution in a harmfully localized and selective manner.

Furthermore, Toncan Iron is structurally uniform. The proper combination of the alloying elements, copper and molybdenum, under the influence of proper furnace and rolling practice, creates and maintains a fine equi-axed grain structure which contributes additional rust-resistance.

It should be pointed out that under conditions favoring rust formation, a protective film may be found on the surface of Toncan Iron. This film is not of the loose, flaky type usually associated with rusted metals but is darker, more inert, denser and more adherent. It is, in fact, so adherent that it actually protects the uncorroded surface beneath it.

WHERE IT CAN BE USED

Toncan Iron offers to the architect the highest degree of resistance to rust and corrosion obtainable among ferrous metals in its price class. It also assures unsurpassed ductility and working qualities. Because of its versatility, Toncan Iron

has met with broad usage and has proved itself in countless installations under severe conditions. The list below will serve to show some of the more common applications of Toncan Iron in the building field.

Air conditioners
Airplane hangars
Arches for bridge flooring
Awning covers
Balustrades
Bathroom cabinets
Belt guards
Blower ducts
Boiler breechings
Boiler jackets
Bridge arches
Brine tanks
Bulletin boards
Cabinet heaters
Cabinets
Canopies

Catch basins
Chimney tops
Cistern filters
Clothes chutes
Clothes dryers
Coal chutes
Condensation pans
Conductor pipe
Coping
Cornices
Corrugated culverts
Dampers
Dishwashers
Doors (exterior)
Downspouts
Drainboards
Drinking fountains
Dryers

Ducts, heating, ventilating and air conditioning
Dust collectors
Eaves trough
Electric heaters
Electrical terminal boxes
Fan housing
Fire doors
Flashing
Forged iron lanterns
Furnaces and pipes
Gas radiators
Gas and oil pipe
Gravel strips for roofs
Gutters
Hospital equipment

Hotel and restaurant equipment
Humidifying pans
Incinerators
Kitchen cabinets
Laboratory equipment
Laundry tubs
Lighting fixtures
Lockers for bathing beaches
Louvers
Mail boxes
Marquees
Metal ceilings
Metal doors
Metal lath
Metal partitions
Oven lining

Pilasters
Playground equipment
Radiator shields
Range boilers
Ranges (coal, gas, electric, oil and gasoline)
Reflectors
Refrigerators
Registers
Roofing
Roof flashings and valleys
Rubbish burners
Septic tanks
Shingles (metal)
Siding
Signs
Sinks

Skylights
Smoke pipe
Stand pipe
Stationary tubs
Switch boxes and covers
Tanks
Underground garbage holders
Urns
Vats
Ventilators
Wall boxes
Waste paper boxes
Water tanks
Window boxes
Window frames
Window sash
Window ventilators



Crown Cork and Seal Company, Baltimore, Md.
Architect—Lucius White

Toncan Iron Sheets used for ventilating and air conditioning ducts.



Old Dartmouth Hall, Dartmouth College, Hanover, N. H.
Architect—J. Fredrich Larson

Toncan Iron used for all sheet metal replacements after fire had badly damaged the building.

TONCAN IRON IS EASY TO FORM



Toncan Iron is exceedingly ductile and can be formed into any commodity which is ordinarily made up of sheet steel or iron. It is much softer than mild steel and, because of its workability, it can be deep drawn, formed, bent, flanged, stamped or spun. It is easy to cut or shear and requires less power and less labor for working. Toncan Iron can be annealed at a temperature of 1200° to 1250° F., to relieve strains caused by working and can be normalized at a temperature of 1700° F., followed by cooling in air to improve the grain structure of the iron after working. It can

be welded, soldered, brazed, riveted, etc., and may be protected with various coatings or galvanized, galvanized, sherardized, etc. The remarkable rust-resistance of Toncan Iron extends uniformly throughout the entire thickness of the metal—not on the surface only—and it is the only commercial ferrous material with rust-resistance practically unaffected by cold-working or deformation. Other ferrous sheet materials ordinarily first dissolve and rust most rapidly at or adjacent to parts which have been cold-worked—such as seams, cut ends, bends and punched holes.

WELDING PROPERTIES OF TONCAN IRON

The excellent welding properties and smooth-flowing behavior of Toncan Iron are valuable in that they make Toncan Iron the ideal metal for work where all joints are to be welded. Toncan Iron lends itself equally well to welding by either the electric arc or gas process. In gas welding, a slight reducing flame should be maintained in order to reduce oxidation to a minimum. In electric arc welding, the use of coated Toncan Iron Welding Rod is recommended.

In gas welding, the deposited metal is practically as resistant to corrosion as the metal itself. This is due to the fact that there is no change in the alloy during the welding operation, for the copper and molybdenum remain unaffected in their relation to the iron with which they are alloyed. Practically the same results can be obtained by the electric arc method, but the use of Toncan Iron electrodes is recommended. The use of Toncan Iron Welding Wire insures a completed job of uniformly high resistance to rust and corrosion throughout.

PHYSICAL PROPERTIES AND CONSTANTS OF TONCAN IRON

The analysis and the chemical and structural uniformity of Toncan Iron assure satisfactory and dependable physical properties. Toncan iron is unique in that it combines with its remarkable rust- and corrosion-resistance, physical properties not found in the best grades of open-hearth steel. Many of these properties are due to the alloy addition of molybdenum. This element entirely dissolves without loss in the iron and thereby has a positive and beneficial effect. It produces a

Physical Properties

Tensile Strength—45,000-58,000 lbs. per sq. in.
Elastic Limit, 30,000-40,000 lbs. per sq. in.
Elongation in 2 in., 30-40%.
Reduction of Area, 60-80%.
Rockwell Hardness, 36-46 (B scale).
Brinell Hardness, 90-120.
Specific Gravity, 7.88 approximately; about 2% greater than that of unalloyed iron or steel.
Electrical Conductivity, about 12½% that of copper.
Thermal Conductivity, slightly better than steel or iron products.
Co-efficient of Expansion, .00000674 in. per degree F. melting point, 2775° F.

Physical Constants

Weight—.283 lb./cubic inch.
Specific gravity—7.88 or approximately that of iron or steel.
Melting point—2775° Fahrenheit.
At room temperature (20° C. or 68° F.):
Electrical resistivity—eight times that of copper or approximately .0000137 ohm/cm. cube = 13.7 microhm/cm. cube = 77 ohm/circular mil foot.
Electrical conductivity—12½% that of copper or approximately 73,000 reciprocal ohm/cm. cube = .013 ohm/circular mil foot.
Thermal conductivity—Slightly better than iron or steel or approximately .18 cal/cm. cube/sec/degree C = .7 watt/cm. cube/sec/degree C.
Linear co-efficient of thermal expansion—.0000121 cm./cm./degree C, 0-100° C. = .00000674 inch/inch/degree F., 32-212° F.



Polytechnic High School, Long Beach, Cal.

Architect—Hugh Davies

Toncan Iron Galvanized Sheets used for all general cornice work, air conditioning, heating ducts, downspouts and gutters.



Yankee Stadium, New York, N. Y.
Engineers—Osborn Engineering Co.

Toncan Iron Sheets used for all Louvres. Air view by Acme Newspictures, Inc.

FORMS AND FINISHES

Hot-Rolled, Hot-Rolled Annealed, Galvanized, Galvanized, Terne Coated Flat Sheets, in all the usual gauges and various popular forms of roofing, galvanized or painted, are available at all times. Roofing may be had in 2, 2½, 3 and 5" corrugated; in Pressed Standing Seam; in 2, 3, 4, 5

and 6 V-Crimp; Pressed Standing Seam; Double Cross Lock Roll Roofing; Roll and Cap Roofing; Weatherboard Siding; Cross Corrugated; and in Plain and Rock Face Brick and Stone Siding.

SIZES AND GAUGES

COMMERCIAL GALVANIZED AND SPECIAL TIGHT COAT, as well as formed roofing products. 12 to 28 U. S. Gauge, inclusive. Width range, 24" to 48". Length, 60" to a maximum of 144".

HOT-ROLLED AND ANNEALED SHEETS—17 to 26 U. S. Gauge, inclusive. Width range, 24" to 60". Length, 60" to a maximum of 180".

HOT-ROLLED AND ANNEALED SHEETS—17 to 26 U. S. Gauge, inclusive. Width range, 24" to 60". Length, 60" to a maximum of 144".

HEAVY COLD ROLLED AND LIGHT COLD ROLLED. 7 to 24 U. S. Gauge, inclusive. Width range, 24" to 63". Length, 60" to a maximum of 120".

LONG TERNES—14 to 28 U. S. Gauge, inclusive. Width range, 24" to 49". Length, 60" to a maximum of 144".

TONCAN IRON OVEN LINING AND TONCAN IRON GALVANNEALED—Gauges 16 to 28, inclusive. Widths up to 54". Lengths to 144".

CORRUGATED ROOFING AND SIDING—

(a) Galvanized—Present standard widths and corrugations. In all lengths, 5' 0" to 12' 0" in 28 gauge and heavier.

(b) Painted —Present standard widths and corrugations. In all lengths, 5' 0" to 12' 0" in 26 gauge and heavier, even gauges.

MAXIMUM SIZES OF SHEETS

This table indicates the rolling limits of Toncan Iron Sheets in hot rolled, annealed, galvanized, heavy hot rolled annealed and special finishes — with the exception that hot rolled, annealed Toncan Iron Sheets are not made lighter than 26-gauge, while galvanized sheets are not supplied in greater length than 144 in. *Uncoated sheets can be furnished in widths and lengths greatly in excess of those shown here. Details upon application.*

GAUGE	LENGTH IN INCHES																	
	Width	24"	26"	28"	30"	32"	34"	36"	38"	40"	42"	44"	46"	48"	50"	52"	54"	56"
No. 28	144	144	144	144	144	144	144	144	144	120	120	120	120	120	120	120	120	120
No. 27	144	144	144	144	144	144	144	144	144	120	120	120	120	120	120	120	120	120
No. 26	144	144	144	144	144	144	144	144	144	144	144	120	120	120	120	120	120	120
Nos. 25 and 24	144	144	144	144	144	144	144	144	144	144	144	144	120	120	120	120	120	120
No. 23	144	144	144	144	144	144	144	144	144	144	144	144	144	120	120	120	120	120
Nos. 22 and 21	144	144	144	144	144	144	144	144	144	144	144	144	144	144	120	120	120	120
No. 20 & heavier	144	144	144	144	144	144	144	144	144	144	144	144	144	144	120	120	120	120

TONCAN IRON PLATES

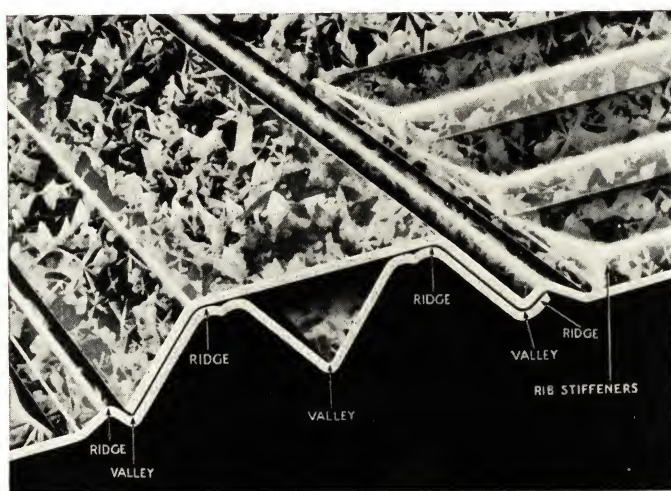
Rust-resisting Toncan Iron Plates are made in thicknesses ranging from No. 10 BWG to 2 in. Sizes range from 24 to 150 in. in width and from 190 to 640 in. in length, depending upon thickness. Hot rolled plates are also available in Steel, Republic Double Strength Steel and Enduro Stainless Steel.

TONCAN IRON STRIP

Hot-rolled Toncan Iron Strip is available in widths from 3½ inches to 36 inches. Through special arrangements, it can be made in widths narrower than 3½ inches, in which case the lightest limit is 16 gauge.

The lightest gauge in which cold-rolled Toncan Iron Strip is offered is 22 gauge. It is available in all widths.

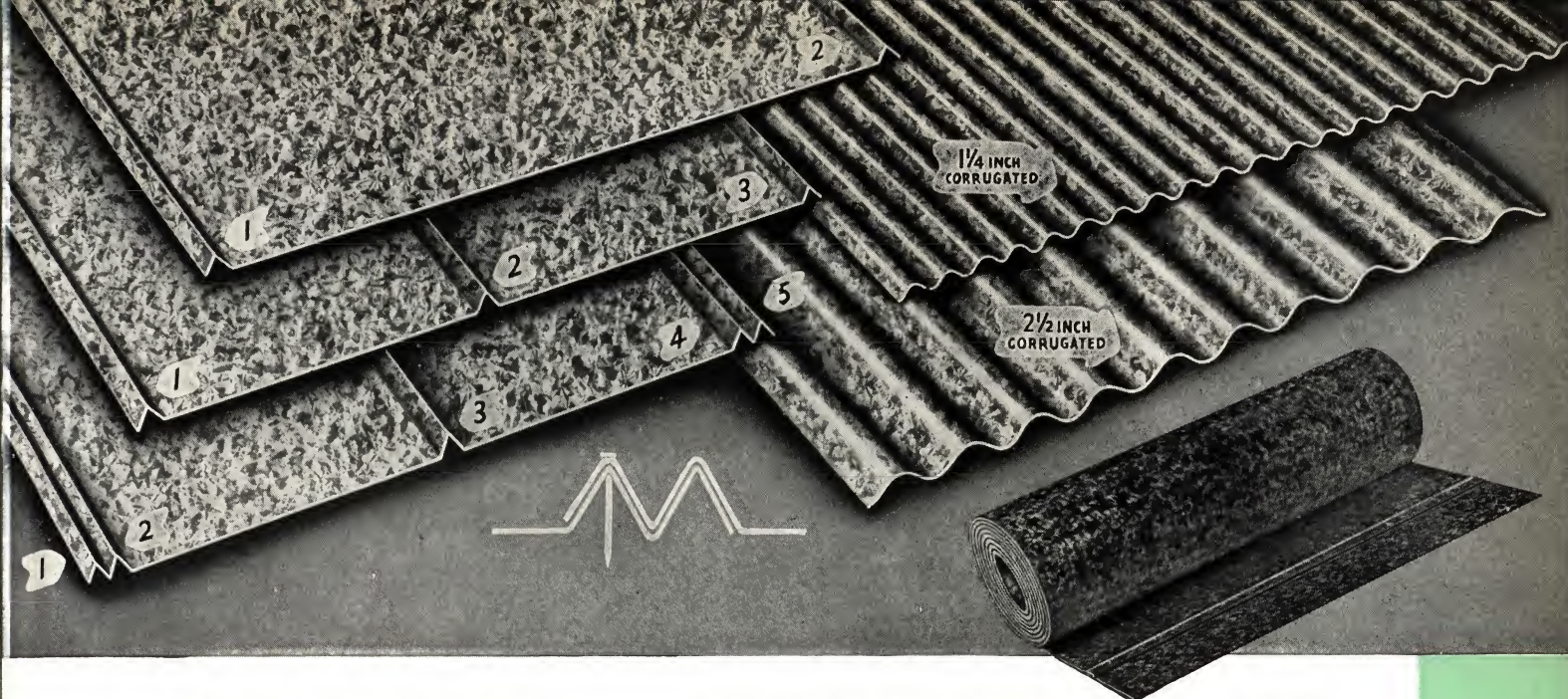
REPUBLIC TRIPLE DRAIN ROOFING



Republic Steel's new Triple Drain Roofing is the ideal channel roofing. Not just a single channel, not merely a double channel—there are actually three channels. With this vastly improved design neither driving rain nor capillary attraction (syphonage or seepage) can cause leaks. A beaded channel makes a tight fit at the overlapping edge, creating a vacuum action. Any rain passing this point through the action of gravity is carried into the center channel which is larger than that on ordinary roofing. Furthermore, rib stiffeners at the end laps of the sheet provide a storm-tight edge.

For convenience in erection, blue lines clearly indicate the proper area for nailing. Lead headed nails are recommended. For roofs of one-quarter pitch or more.

Covering width—24 inches. Lengths, 5 to 12 feet inclusive. Triple Drain adjustable ridge roll, end wall flashing, gambrel roof joints, overhang eaves drip and gable end starters are also available.



V-CRIMPED ROOFING

- V-crimped is the oldest form of roofing, and has been used extensively. The construction is simple and makes a good appearance at reasonable cost. This roof can be applied over close sheathing, to strips spaced four or five inches apart or over old shingles. The 3V-crimped is a pleasing variation from the standard and makes a stiffer sheet, while 5V-crimped is still stronger. All three styles are supplied in lengths of 5, 6, 7, 8, 9, 10, 11, and 12 feet and in gauges 24 and lighter. Actual covering width of each style is 24 inches.

CORRUGATED SHEETS

- Corrugated sheets offer the advantage of light weight with great lineal rigidity. This advantage, plus the fire protection offered by corrugated sheets, accounts for their almost universal use in roofing and siding for industrial buildings, warehouses, mine buildings, and other large structures in the vicinity of railroads. Corrugated sheets are also an ideal material for barns, garages, sheds, and a wide variety of other buildings. The 1 1/4-inch style is supplied in gauges 20 and lighter; the 2 1/2-inch style in gauges 10 and lighter. Both styles are 26 or 27 1/2 inches wide; lengths, 5, 6, 7, 8, 9, 10, 11, and 12 feet.

ROLL ROOFING

- Especially useful where pitch of roof is slight and for wide areas. Cross seams are double locked. Each roll contains 50 lineal feet. Covering width is 24 inches. Gauges 26, 28, and 29.

CROSS-CORRUGATED SHEETS



- Used for elevators and other high buildings where there is some motion of the building in the wind or where the structure may settle. The nails in each sheet are driven 2 inches above the edge of the sheet below, which allows the building to settle or move without loosening the sheets. The standard size for this type of sheet is 26 x 32 inches, providing for a covering width of 24 inches, with a 2 inch lap.

PRESSED STANDING SEAM ROOFING



- Strong and attractive, this is one of the most perfectly watertight of all metal roofings when properly applied, as no nails are driven through the roofing sheets. Covering width, 24 inches. Lengths, 5, 6, 7, 8, 9, 10, 11, and 12 feet. Galvanized; gauges 28, 26, and 24. Painted; gauges 26 and 24.

RIDGE ROLL



Plain

Made with or without nailing flange; lengths, 10 feet. Size of rolls, 1 1/4, 1 1/2, 2, 2 1/2, and 3 inches. Size of aprons, 1 3/4, 2, 2 1/2, 3 and 3 1/2 inches. Girths, 7, 8, 10, 12 and 14 inches. Gauges, 29 and 26.



Corrugated

Used with corrugated roofing. Length, 28 and 96 inches. Made with 2 1/2-inch or 1 1/4-inch corrugations with 2-inch roll; 4-inch apron; 12-inch girth.

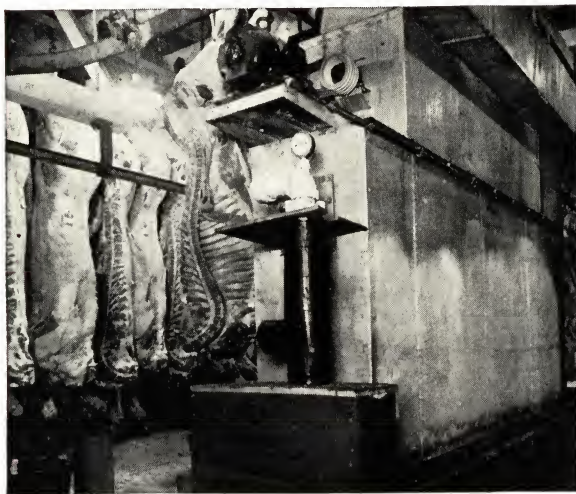


ARCHITECTURAL FORUM

Hillside Heights Development, Long Island, N. Y.

Toncan Iron used on all gutters and downspouts in this 150-home development. Courtesy Carl Evers, Realty Associates.

TONCAN IRON PRODUCTS *in* *Air Conditioning*



Laclede Packing Company, St. Louis, Mo.
Engineers—R. H. Tait & Sons Corp.

Toncan Iron used for 600 feet of pipe and for structural sheets in the all-welded conditioning unit.

Toncan Iron Pipe and Sheets Offer Maximum Corrosion-Resistance in Air Conditioning

The marked superiority of Toncan Iron Pipe for water supply, circulating and effluent lines, ammonia cooling coils and steam coils has been amply demonstrated. Toncan Iron Sheets for ducts and other sheet metal applications in air conditioning have already established records for long life under severe conditions. The reason for this outstanding performance lies in the base metal itself—an alloy of refined open hearth iron, copper and molybdenum which possesses greatest corrosion-resistance among ferrous metals in its price class.

Corrosion Is Major Problem

In the selection of ferrous materials for air conditioning systems, the architect and the engineer are faced with a definite problem of combating corrosion in (1)

central station air conditioning units and (2) ducts through which the conditioned air is carried to different parts of the building. Replacement of failed metal parts in air conditioning installations is an extremely costly matter. Hence, insurance of maximum life for these parts is a fixed responsibility of the architect or engineer.

Corrosion in Central Station Systems

In this type of air conditioning system, impurities are removed from the air in varying degrees by passing it through water sprays. The impurities which are thus removed by washing are mainly acidic in character, such as carbon dioxide, sulphur dioxide and, to a lesser degree, sulphur trioxide. The system also acts as a humidifier or dehumidifier according to outside weather conditions.

Both the water supply lines and the circulating or effluent lines are subject to corrosive conditions—the supply lines from raw water and the circulating lines from water containing impurities removed from the air. In many cases the water supply is treated to remove impurities which tend to attack the pipe. Such treatment, however, is not fool-proof. The pipe which carries the water to the sprays must be able to withstand corrosive attack during *any* period when conditions are *abnormal* and when all impurities are *not* removed. Even though the water may be satisfactorily treated for six days out of the week, provision must be made to combat corrosion on the seventh day when treatment may not remove all impurities.

Superiority of Toncan Iron Pipe for these lines is due to the high corrosion-resistance of the metal demonstrated in both laboratory and field.

Corrosion in Air Conditioning Ducts

The life of galvanized ferrous sheets in duct systems is affected by the following:

(1) Moisture originally present in the air as water vapor, or moisture held in mechanical suspension deposits out on the sheet as a result of temperature changes. This applies to *both* the interior and exterior of the duct. A cold air duct passing through a warm room will "sweat" on the exterior.



Capitol, Senate and House Office Buildings, Washington, D. C.

Toncan Iron used for pipe lines and air conditioning equipment.

(2) Moisture deposits out in certain critical areas of the ducts as a result of the circuitous, angular paths often necessary. Air flow obstructions cause deposit of moisture mechanically and electro-mechanically.

(3) Moisture deposits out as a result of the presence of dust particles or hygroscopic products of corrosion.

(4) Improperly or insufficiently washed or filtered air contaminates the moisture with sulphurous acid, sulphuric acid and hydrogen sulphide.

These Tests Show Why Toncan Iron Should Be Used

Test No. 1—Air conditioning system operates 8 hours a day for 5 days a week. Test specimens immersed in *untreated* water in dehumidifier.

Test No. 2—Air conditioning system operates 24 hours a day, 7 days a week. Test specimens immersed in *treated* water spray in dehumidifier.

Corrosion Loss

Material	Milligrams per sq. in.		Appearance	
	Test No. 1	Test No. 2	Test No. 1	Test No. 2
Plain Open	73.2	.93	Deep, scattered pits	Few shallow pits
Hearth Steel				
Copper-Bearing	71.8	.80	Deep, scattered pits	Fewer shallow pits
Steel				
Toncan Iron	67.7	.67	Shallow scattered pits—uniform attack	No pits—uniform attack

The above results of scientifically conducted tests show the ability of Toncan Copper Molybdenum Iron Sheets and Pipe to resist corrosive action of both treated and untreated water used in air conditioning. Toncan Iron justifies its use in air conditioning applications because:

(1) It affords highest degree of resistance to corrosion, thus assuring longest service performance.

(2) It will save much replacement cost, especially when ducts are built-in or are otherwise inaccessible. This is true even though best operating control of treated water and air is assured.

How to Specify Toncan Iron Sheets

Toncan Iron Sheets are stocked by jobbers in all large cities. Be sure to specify: "All sheet metal work shall be rust-resisting Toncan Copper Molybdenum Iron manufactured by Republic Steel Corporation." In cases where public institutions do not use trade-names in specifications, Toncan Iron Sheets may be specified as: "Alloyed iron sheets of open hearth iron, copper and molybdenum produced by the basic open hearth process, containing no less than .40 per cent copper and .05 per cent molybdenum."

For your protection, every Toncan Iron galvanized sheet is stenciled at approximately two-foot intervals with the Toncan Iron trade-mark in green. Smaller formed products are die stamped with the trade-mark and maker's name. The gauge also is clearly shown.

Look for the green Toncan Iron trade-mark—it's your assurance of longer sheet life, easier working quality, and greater economy.

REPUBLIC TAYLOR ROOFING TERNES

"TARGET AND ARROW" BRAND

Since 1810 the Taylor name has identified tin roofing of the high quality obtained only by coating the sheets by means of the so-called "old style" process. This process calls for craftsmanship of the highest order and insures perfect amalgamation of the three metals. Consequently, Taylor "Target and Arrow" Brand Roofing Ternes offer unexcelled durability.

To assure maximum service life, the base metal of these ternes is rust-resisting copper-bearing steel. Thus, to the highly efficient protective terne coating is added the ability of the base metal to resist to a high degree the attacks of corrosion, resulting in a roofing material of easy workability and long life.

Forms Available

Republic Taylor Copper-Bearing Roofing Ternes are supplied in standard flat sheets and in rolls of 100 square feet or 100 lineal feet.

Sizes and Gauges

Available in two sizes, sheets 14" x 20" and 20" x 28", packed 112 sheets to the box. Furnished in IC thickness (approximately 30 U. S. Gauge) and IX thickness (approximately 28 U. S. Gauge). Weight per 100 square feet laid on the roof, about 65 pounds for IC thickness. Coating weights: In addition to Target and Arrow Brand, plates can be furnished in coatings as follows—8 lb. (Saxon); 15 lb. (Avalon); 20, 25 and 30 lb. (Old Method); 40 lb. (Old Method and Taylor Extra Coated); 20 lb. (Fire Protection). 100 Square Foot Rolls contain 28 sheets, each 20" x 28". Width either 20" or 28". Rolls 14" wide contain 56 sheets 14" x 20". Surface measurement approximately 103 square feet. Seams are carefully soldered. Painted one or both sides.

100 Lineal Foot Rolls are available in 14", 20" and 28" widths.

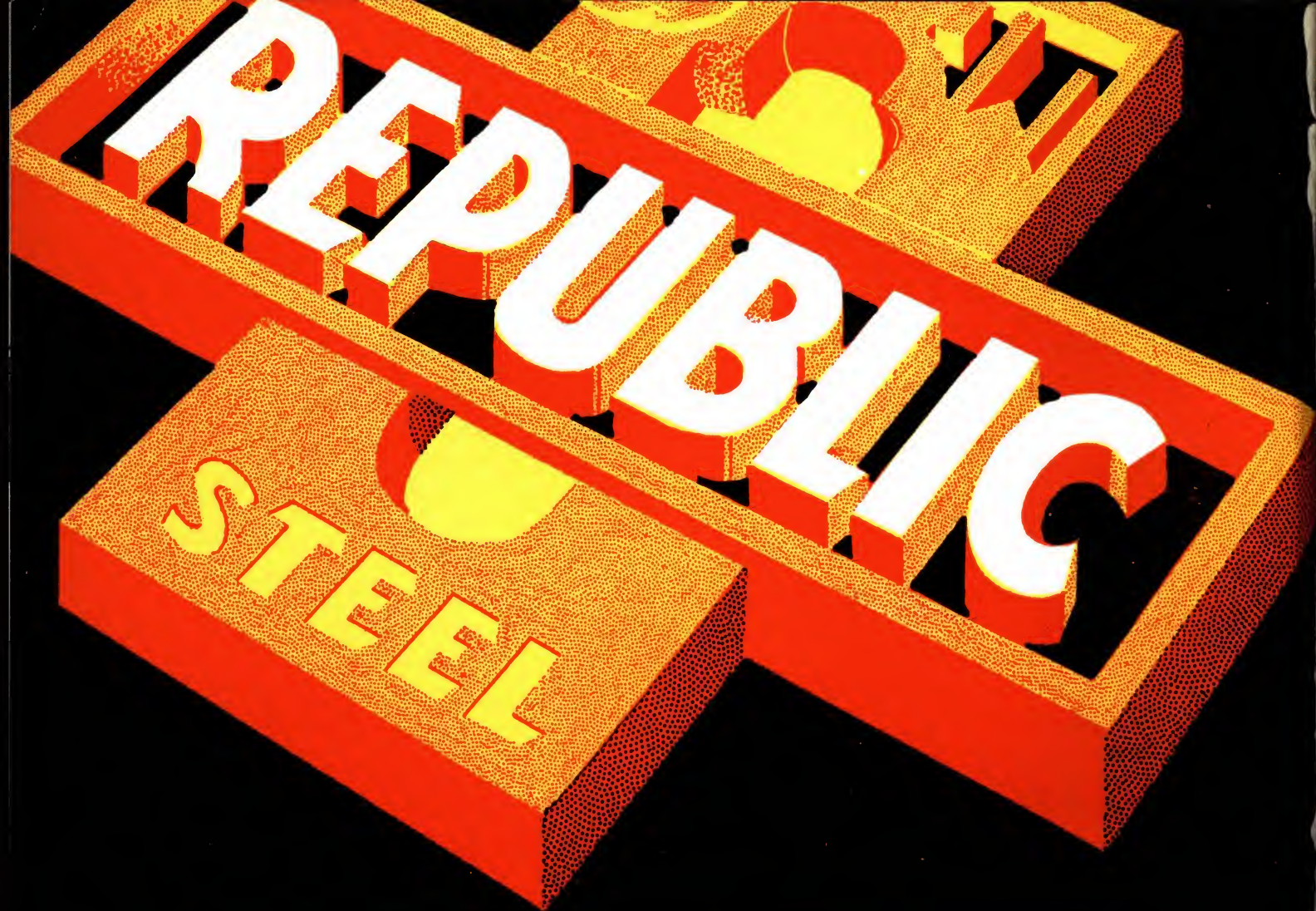
Identification

Sheets are stamped with weight of coating, grade and brand. This information is also stenciled on boxes.



(Above)
Grand Central News Reel Theater, New York, N. Y.
Architect, Sloan & Robertson
Toncan pipe and sheets used for refrigeration and air conditioning ducts.

Residence of Mr. Moses King, Shaker Heights, Ohio
Architect, John W. Little
Toncan Iron used for all Air Conditioning Ducts; also for gutters and downspouts.



REPUBLIC STEEL CORPORATION

GENERAL OFFICES CLEVELAND, OHIO

ALLOY STEEL DIVISION MASSILLON, OHIO

DISTRICT SALES OFFICES

ALBANY, N. Y., State Bank Bldg.
 BIRMINGHAM, ALA., Empire Bldg.
 BOSTON, MASS., 250 Stuart St.
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 CHICAGO, ILL., McCormick Bldg.
 CINCINNATI, OHIO, Carew Tower
 CLEVELAND, OHIO, Republic Bldg.
 DENVER, COLO., Continental Oil Bldg.
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MILWAUKEE, WIS., First Wisconsin National Bank Bldg.
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 YOUNGSTOWN, OHIO, Republic Bldg.

Canadian Representative, Toronto, Ont.

EXPORT DEPARTMENT, Chrysler Bldg., NEW YORK, N. Y., U. S. A.

Warehouse Stocks of Enduro Stainless Steel and Toncan Copper Molybdenum Iron are carried in Principal Cities. For Local Distribution contact the nearest Republic Sales Office

Enduro Licensed under Chemical Foundation Patent No. 1339378